The

Electrical Review

VOL CI. NOVEMBER 18, 1927. No. 2,608.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

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OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address "AGEEKAY, CENT., LONDON," Code, A B C. Telephone No.: Central 7672 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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The London Transport Problem.

AS reported in our issue of November 4th, the London and Home Counties Traffic Advisory Committee, under the chairmanship of Sir Henry Maybury, has very emphatically recommended the adoption of a scheme for bringing the whole of the passenger transport facilities in the London area under common management, with a common fund into which all gross revenue balances would be paid and from which the revenue liabilities of all the undertakings concerned would be met, the surplus being distributed in accordance with the principle that each party shall have a reasonable return upon the capital expended. The Committee regarded the matter as one of such urgency that it requested authority to open negotiations with the respective undertakings "at the earliest possible moment," on the ground that no substantial improvement could be effected in the traffic of greater London until some such scheme was brought into operation.

On October 13th the Minister of Transport invited the London County Council to communicate to him its views on the subject, with the least possible delay, and last week the report of the Special Committee on Traffic was presented to the Council and adopted. In this report the Committee recalled the inquiry which was instituted by the Council in 1920, when the Special Committee of Inquiry expressed the view that permanent improvement was impossible unless some concerted effort was made to regulate the unrestricted competition between the various means of local passenger transport; if the undertakings were worked in co-ordination very great benefits would be secured for the public, and considerable financial advantages would accrue to the individual undertakings. The Council at that time accepted the principle of unified operation of local passenger transport undertakings, and recommended the establishment of a municipal traffic control authority, but did not deal with administrative ques-

tions; the Traffic Advisory Committee was afterwards set up, but was not purely municipal, and its functions were advisory only. The resolution which the Council has now adopted (Electrical Review, November 11th, 1927, p. 825) carries the matter very much further, as it expresses approval of the principles embodied in the Advisory Committee's report, namely, common management and a common fund. In view of the fact that the London County Council is by far the most important of the municipal authorities interested in the question, this is a long step in the desired direction, whilst the fact that the essence of the scheme was put forward by the representative of the General Omnibus and Tube Railway Companies at an inquiry last year is evidence of the favourable attitude of that large group towards the proposition.

In view of these circumstances, it is not unreasonable to hope—in spite of the long delays and the repeated disappointments that London has had to bear on previous occasions—that at last something will be done. Those who live and work in the London district and suffer from the difficulties of transport which afflict that over-populated and over-grown area will hail with joy any proposal whatever that purports to relieve them of the trammels which, like a subtle form of paralysis, clog the wheels of traffic and handicap communication, imposing upon the capital city a continual handicap.

Legislation will be required to enable a scheme of this nature to be carried out, and in this connection the position of the tramway undertakings might well receive consideration. That tramways are essential to the solution of the traffic problem in large towns is indisputable; in this country some extreme advocates of the motor omnibus maintain that the railed vehicle is obsolete, but on the Continent, and in the United States, and in the British Dominions the supremacy of the tramway for the purpose of urban transport is unquestioned. No one who observes the congestion that takes place in London streets where motor omnibuses attempt to cope with the traffic without the aid of the tramway, can fail to realise the drawbacks entailed by the smaller capacity of the 'buses and the greater number required to deal with the problem; in many important thoroughfares the 'buses at times constitute the bulk of the traffic and are almost wholly responsible for the congestion, and the loss of time consequent thereupon. The failure of the London tramways to pay their way is not due to inefficiency but to the heavy financial burdens that they have to carry in respect of the excessive cost of the conduit system, the maintenance of the roadway, the transportation of workmen at less than cost, and other factors which do not operate in the case of omnibuses. The latter, however, have proper functions which they alone can fulfil, and the same is true of the tube railways. There is room for all these systems, and each in its own sphere is indispensable. The bane of the existing conditions is excessive and ill-advised competition; co-ordination is the key to the problem, and the admirable scheme put forward by the Advisory Committee should command the warm support of those who place the public welfare above all other considerations. The subject is ably dealt with by Mr. H. Marsh in a paper to be read before the Public Works, Roads, and Transport Congress to-day, of which an abstract will appear in our next issue.

Rural Electric Lines.

During the past four months we have published a series of articles in which well-known engineers have set forth at some length the difficulties they have met with in carrying out schemes for electricity supply in rural areas, and the remedies which they suggest for those troubles. We believe that these frank statements have pretty fully covered the ground and adequately represent the existing situation without further excursion into detail, and that they will exercise a material influence on the course of events—in fact, they have done so, for the newly-established "Overhead Lines Association" was the direct outcome of the series and the correspondence to which it gave rise, and that energetic body has already commenced operation in good earnest, as may be gathered from the report of its first meeting which appeared in our last issue. Apart from this result, however, valuable though it undoubtedly is, we hope that the articles themselves will be studied by those who are in a position to take action in the directions indicated and to lighten the burden which at present rests on the shoulders of enterprising engineers who wish to promote the use of electricity in every corner of the areas committed to their care.

It remains only to show that the authors of the articles have plenty of sympathisers, and that further evidence would be available in abundance to the same effect if it were necessary to produce it. We have therefore invited a few pioneers and experts in aerial line construction to express very briefly their feelings on the subject and thus to record their votes, so to speak, in connection with our symposium. These will be found on a later page, and form the final instalment of the series. We are greatly indebted to all the busy men who have lent their support to this campaign; the time that they have given to the cause has not been mis-spent, for the mass has been set in motion and success is certain if the pressure is maintained, a function which the "Overhead Lines Association" may be counted upon to fulfil.

Lighting Service.

One of the finest examples of collective propaganda which has ever come to our notice is the Lighting Service Bureau at Savoy Hill, W.C., which has recently been re-arranged and improved.

We publish on another page some illustrated notes upon the reconstructed premises, but we have to confess that neither the text nor the pictures convey a fair or adequate idea of this really remarkable display. In a number of ways the correct use of electric light is demonstrated most effectively. Domestic lighting is given very full attention mainly by the display of the correct lamps and fittings in appropriate settings. One means adopted—the revolving "house"—is surely one of the best schemes in this direction which have yet been evolved. The arrangement of the entrance hall follows the lines laid down by Mr. H. E. Walker in his paper at this year's E.C.A. Convention; four apartments have been arranged each with examples of bad and correct lighting, while extending across the ceiling from each apartment are selections of appropriate alternative fittings. Some beautiful examples of shop-window lighting are on view, including a colour-lighting display with a series of variations which go on for half-an-hour without repetition. Workshop and class-room lighting are given attention (the model workshops are works of art), and there is a fine collection of electric signs and other methods of advertising by light.

A visitor can walk in and be shown a number of really entertaining demonstrations, and entirely forget the commercial idea behind it all. This, we consider, is the acme of advertising. There is no pill in the jam; lighting ideals are subtly impressed upon the mind, and no word is said regarding the purchase of lamps and fittings. The light is left to sell itself, and it does it very well. Nobody will leave the Bureau in a contented frame of mind; the hopeless inadequacy of his home lighting, of the illumination of his shop or factory, and his streets will have been thoroughly impressed upon the visitor before he departs. And that is where the Electric Lamp Manufacturers' Association reaps its reward for performing what is really a public service! We urge all who can to inspect the Bureau; they will be courteously received by Mr. Bush and his staff, and will most certainly enjoy the experience and benefit from it. We may say in conclusion that even Americans have picked up hints on lighting service at the Bureau, and that—to some—would appear to be very high commendation.

The Generation of Electricity Direct from Heat.

Particulars and Results of recent Researches on Thermoelectric Generators.

By T. F. WALL, D.Sc.

THE problem of generating electrical energy direct from heat without the use of any rotating parts whatever is an attractive one. As a subject for electrical engineering research, however, it appears to have been strangely neglected, and the possibility of building a thermoelectric generator which shall take a place as a practical and competitive means for generating electrical energy seems to have been almost completely ignored in recent years.

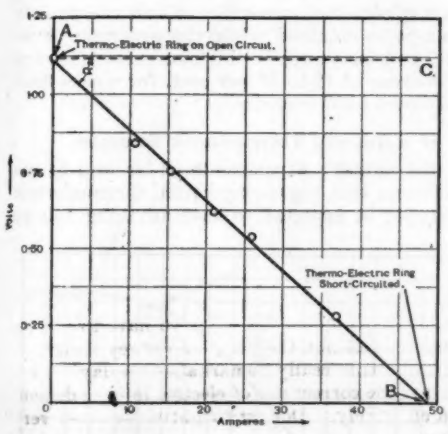


Fig. 1.—External Characteristic for a Single Thermoelectric Ring.

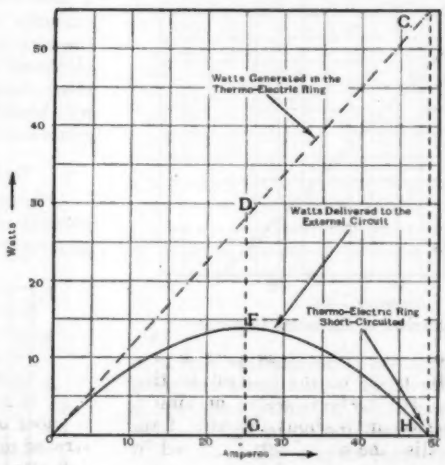


Fig. 2.—Results of Tests on a Single Thermoelectric Ring.

The author feels convinced that, in view of the great advances which have been made in recent years in the production of heat-resisting alloys and the work which has been successfully accomplished in protecting certain metals from corrosion, the thermoelectric generator has been brought within the realm of commercial feasibility.

The Output of a Thermoelectric Generator.

If a thermocouple, or a series-connected group of thermo-couples, is short-circuited, the whole of the e.m.f. generated due to the temperature difference between the hot and cold junctions will be used in generating the short-circuit current.

In fig. 1 are shown the test data obtained from a thermoelectric ring, which forms one section of a thermoelectric generator, designed for use with a coke furnace. The ring comprises 22 elements in series, the couples being formed of copper and constantan. The straight line AB gives the relationship between the p.d. at the terminals of the ring and the current in the circuit. By varying the resistance to which this generator ring is connected, a number of points on the straight line AB may be found, and these experimental points are shown marked in fig. 1. The conditions for which the straight line AB was obtained were such that the temperature difference between the hot and cold junctions was maintained constant for all values of the current through the circuit, that is to say, the open-circuit e.m.f. was maintained constant throughout the test.

In this connection it is to be observed that, when the thermoelectric generator is supplying a current, the power to which this current corresponds is obtained by a cooling of the hot junctions, that is, by reason of the Peltier effect. Hence, when the current has flowed for a short while, the hot junctions become appreciably cooled. This is seen to be the case when the circuit is switched open. It is then observed that the e.m.f. gradually rises after the current has ceased to flow. Similarly, if the p.d. at the terminals of the generator be noted immediately after the switch has been closed, it will be found that the p.d. gradually falls, due to the cooling of the hot junctions by the passage of the current.

Reverting to fig. 1, the dotted horizontal line AC represents the e.m.f. generated by the thermoelectric ring and, since the temperature difference between the hot and cold junctions is maintained constant, the developed e.m.f. will be constant for all values of the current. Actually, instead of regulating the supply of heat to ensure this constancy of developed e.m.f., the test data were obtained by observing the current and terminal p.d. immediately the switch was closed, that is, before the hot junctions had time to cool down by an appreciable amount.

Let E volts be the e.m.f. developed.

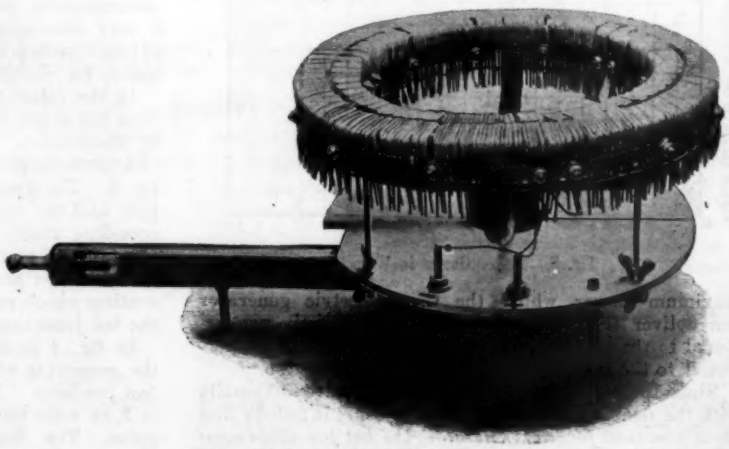


Fig. 3.—Gas-heated Thermoelectric Generator.

Let V volts be the p.d. at the terminals of the thermoelectric generator.

Let I amperes be the current through the generator.

Let R_x ohms be the resistance of the external circuit to which the generator is connected.

Let R_i ohms be the internal resistance of the generator.

Then $I = E/(R_x + R_i)$ amperes,

also $I = V/R_x$ amperes,

so that $E = IR_x + IR_i$ volts,

$= V + IR_i$ volts,

or $R_i = (E - V)/I = \tan a$ (*see* fig. 1).

That is to say, the slope of the line AB will be a measure of the internal resistance of the generator. The line AB may be termed the *external characteristic* of the generator.

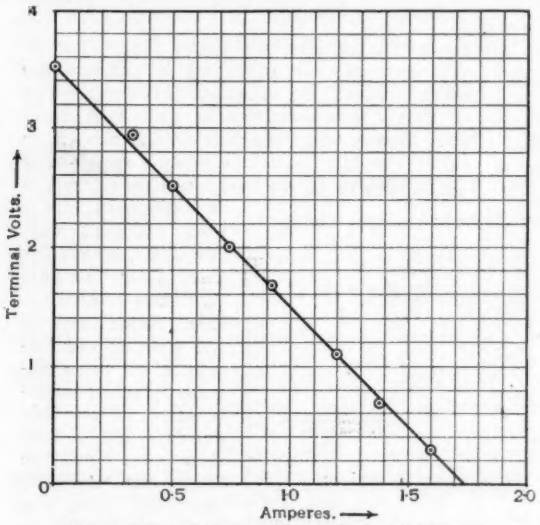


Fig. 4.—External Characteristic of Gas-heated Generator.

Considering now the power relationships shown in fig. 2, the total power developed by the generator when the current is I amperes will be EI watts, and this is represented by the chain-dotted line OC in fig. 2. The power delivered to the external circuit will be—

$W = VI$ watts,

$= (E - IR_i)\, I$ watts,

that is, $W = EI - I^2R_i$ watts.

This is the equation of a *parabola*, and is shown by OFH in fig. 2.

The maximum power which the generator can deliver to the external circuit is given by the maximum ordinate FG of the parabola. That is, the maximum possible output of the generator is—

$$W = \tfrac{1}{4}E^2/R_i \text{ watts.}$$

The power developed when the generator is short-circuited is E^2/R_i watts. It is seen, therefore, that the

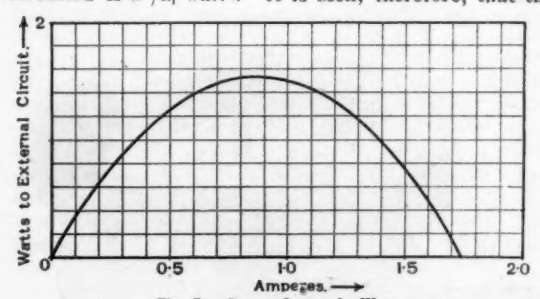


Fig. 5.—Power Output in Watts.

maximum power which the thermoelectric generator can deliver to the external circuit is directly proportional to the square of the e.m.f. and inversely proportional to the internal resistance of the generator.

Since the e.m.f. increases more or less proportionally with the temperature of the hot junctions, it follows that *for a practical form of generator, the hot junctions must be maintained at the very highest temperature possible. It is further essential that the internal resistance of such a generator shall be as low as possible. These two fundamental requirements form the foundation basis for the design of a practical form of thermoelectric generator.*

The essential requirements, therefore, are that the cool junctions shall remain reasonably cool whilst the hot junctions are maintained as hot as possible, and at the same time the internal resistance of the generator must be as low as possible. A little consideration will show that these requirements are largely conflicting, and this forms one of the chief difficulties attending a practicable design of thermoelectric generator.

Referring again to fig. 1 it will be seen that the developed e.m.f. for this thermoelectric ring of 22 couples is 1.12 volts, that is to say, the e.m.f. developed per couple is 0.05 volt, which is relatively a very high value. Further, the short-circuit current is 49 amperes, so that the internal resistance of this thermoelectric ring is $1.12/49 = 0.023$ ohm.

The maximum useful power which can be obtained from this ring is $1.12 \times 49/4 = 13.7$ watts.

The electrical power actually developed at short-circuit is $1.12 \times 49 = 55$ watts.

From the tests made by the author it appears that the *useful thermal efficiency* which can be obtained with a coke-fired thermoelectric generator of about ½ kW capacity is about 3 to 4 per cent. On the other hand, the *maximum efficiency of conversion of heat energy into electrical energy* is obtained when the generator is on short-circuit, and consequently this maximum efficiency will be of the order of 12 to 16 per cent. for a coke-fired generator of about ½ kW capacity.

Tests of a Gas-ring Thermoelectric Generator.

Although the author's experiments so far lead to the general conclusion that a gas-ring-heated thermoelectric generator cannot be expected to have anything like so

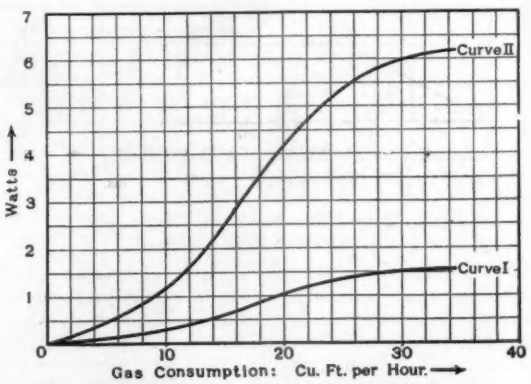


Fig. 6.—Relationship between Output and Gas Consumption.

high a thermal efficiency as a coke-fired generator, yet the great convenience and ease of control make a gas-ring-heated generator a very useful substitute for small accumulators, particularly for those purposes for which a very steady source of e.m.f. is required. This type of thermoelectric generator also provides a valuable means for charging electric accumulators.

In the following is given a brief account of the test data for a gas-ring-heated generator recently designed by the author.

A photograph of the completed generator is shown in fig. 3. The gas ring has an inner and an outer row of jets, and the thermo-couples are arranged in two corresponding rings. The couples are formed of iron and constantan, and the hot junctions are protected from deterioration and disintegration by means of a special coating which can withstand the temperatures at which the hot junctions are normally operated.

In fig. 4 is shown the "external characteristic" of the generator when the gas consumption is 34.5 cubic feet per hour. It will be seen that the developed e.m.f. is 3.52 volts and the short-circuit current is 1.75 amperes. The internal resistance of the generator is therefore $3.52/1.75 = 2$ ohms, when operating with this gas consumption.

In fig. 5 is shown the relationship between the power in watts delivered to the external circuit and the current in the circuit. This curve is deduced from the external

characteristic of fig. 4 as already explained with reference to fig. 2 in the foregoing. It is seen that the maximum output of the generator is 1.54 watts for the conditions of operation to which fig. 4 refers. At short-circuit, however, the power which is actually developed by the generator is $3.52 \times 1.75 = 6.16$ watts.

A series of external characteristics were also taken for the following values of the gas consumption, *viz.*, 29.0, 20.5, 18.3, 12.6, and 10.0 cubic feet per hour respectively.

In fig. 6 is shown by curve I the relationship between the maximum power delivered to the external circuit and the gas consumption, whilst curve II shows the relationship between the power developed by the generator at short circuit and the gas consumption. From what has been said in the foregoing it will be clear that for any given value of the gas consumption, the ordinate of curve II will be four times the corresponding ordinate of curve I.

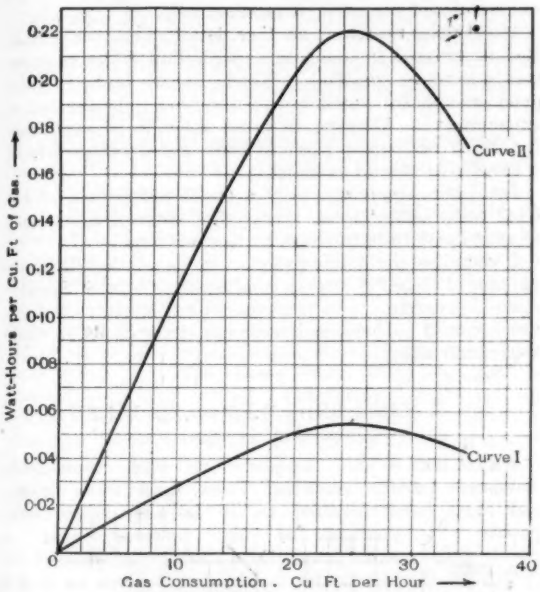


Fig. 7.—Watt-hours per Cubic Foot of Gas.

The shape of the curves in fig. 6 is interesting. It will be seen that an increase of gas consumption beyond about 30 cubic feet per hour gives very little increase in output, whilst for a gas consumption less than about 10 cubic feet per hour the power developed is relatively very small.

In fig. 7 are shown curves giving the electrical energy generated in watt-hours per cubic foot of gas as a function of the gas consumption, curve I showing the watt-hours per cubic foot when the output is a maximum, and curve II showing the watt-hours per cubic foot when the generator is short-circuited. The curves I and II of fig. 7 have been deduced from the corresponding curves of fig. 6 as follows:—For any given value of the gas consumption, say for example, 20 cubic feet per hour, the watts given by curve I, fig. 6, is about 1.02. If this value of the watts is divided by the gas consumption, *viz.*, 20 cubic feet per hour, the result is 0.051 watt-hour per cubic foot of gas, and this value is plotted in fig. 7 as the ordinate for the gas consumption of 20 cubic feet per hour. In this way curve I of fig. 7 has been derived from curve I of fig. 6, and curve II of fig. 7 from curve II of fig. 6.

The curves of fig. 7 show the interesting result that a maximum efficiency of operation is obtained when the gas consumption is about 24 cubic feet per hour. For a range of values of gas consumption from 20 to 30 cubic feet per hour, the efficiency is not far from the maximum value.

It is of interest to inquire what thermal efficiency these results denote. Assuming that 1 cubic foot of gas has a heat value of 500 B.th.u., and noting that 1 watt-hour is equivalent to 3.41 B.th.u., it will be seen that for a gas consumption of 24 cubic feet per hour, the number of watt-hours per cubic foot of gas given by curve I is 0.055, that is, 0.19 B.th.u.

That is to say, the thermal efficiency obtainable when the generator is delivering its maximum output for a gas consumption of 24 cubic feet per hour is $0.19/500 = 0.04$ per cent., very nearly.

If the generator is short-circuited when the gas consumption is 24 cubic feet per hour, the number of watt-hours of electrical energy actually generated per cubic foot of gas is given by curve II, fig. 7, as 0.22, that is, 0.75 B.th.u. The thermal efficiency in this case, therefore, is $0.75/500 = 0.15$ per cent.

As already stated, a high value for the thermal efficiency cannot be expected for this particular type of gas-heated generator. For a coke-fired generator, however, the values of the thermal efficiency become enormously greater *viz.*, from 3 to 4 per cent., when the generator is delivering its maximum output, and from 12 to 16 per cent. when the generator is short-circuited.

Rural Electric Lines.—VII.

A Symposium of the opinions of electrical engineers experienced in the construction of overhead lines in rural areas, with examples of methods that have been, or are to be, adopted for the distribution of electricity at low and medium pressures.

HAVING set forth detailed statements in previous instalments of this series,* we conclude with a collection of brief expressions of opinions held by engineers who have played a leading part in the erection of overhead lines both for transmission and for distribution purposes. It will be seen that all are agreed as to the urgent necessity for reform in the conditions which at present hamper the development of rural electricity supply and impose upon it financial burdens which will have to be borne for many years to come.

* Previous articles appeared in the ELECTRICAL REVIEW for July 15th and 22nd, August 5th, 12th, and 26th, September 2nd, 9th, 16th, and 23rd, and October 14th, 1927.

Mr. S. E. Britton, M.I.E.E., Engineer and Manager, Chester Corporation Electricity Dept.

Whatever be the outcome of the almost continuous effort which has been made in different quarters since the publication of the Electricity Commissioners' El.C.39 in 1923 to bring about a code of regulations commensurate with the safety of the public and the public needs for the electric, telephonic, and telegraphic services, the articles and expressions of opinion which have appeared recently in the electrical Press emphasise the necessity for immediate action by those responsible for the regulations concerning these services.

It is a significant fact that those who are engaged upon the erection of overhead electric lines and have taken trouble to analyse the practical effect of the Com-

missioners' and Post Office Regulations invariably come to the conclusion that the present regulations impose a wanton waste of money, labour, and materials, involve unnecessary damage and alterations to property and amenities, and impede the development and use of electricity in sparsely-populated districts.

The capability and behaviour of the different materials of which overhead lines are composed are as stable as the materials used for other structures which may affect the public.

There are no abnormal engineering difficulties or dangers associated with the use of overhead electric lines when constructed in accordance with recognised engineering principles. The problem is a comparatively simple one, and could be properly dealt with by a minimum amount of regulations and simpler facilities than those required and given by Parliament for such public services as railways and water supplies.

It cannot be disputed that a vast sum of money has already been uselessly spent and is being spent on overhead lines. The effect of this is to strengthen the view that the requirements for safeguarding the public and for facilitating the supply of electricity by overheal lines have not been correctly visualised by the Government in this country.

In view of the failure of the efforts to bring about a new set of conditions and adequate facilities, there is justification for suggesting that it will be a further waste of time and money to pursue this agitation through what should be the expeditious channel for redress, namely, the Government Department charged with the control of the public services of electricity, telephones, telegraphs, and highways.

If the experience I have had in areas not supplied with electricity is a criterion of the views of the public generally in such areas, then there is an enthusiastic demand for electricity throughout the country and a willingness to pay for an electrical service quite apart from a tariff of charges based on a unit charge—but this is no justification for wasting our resources.

Intensely do I dislike to make the suggestion, but as I go round the country districts into which the Chester Corporation has taken electricity, on every hand am I reminded of time, labour, and money unnecessarily spent on overhead lines; this compels me to the conclusion that it is expedient, without further delay, to solicit the aid of the sitting politicians, and the aspirants for such honours, at the next Parliamentary election in such districts in the cause of new conditions and greater facilities in respect of overhead electric lines.

The matters which are most pressing are:—

(1) Factors of safety.
(2) Clearance between lines and ground and buildings and Post Office lines.
(3) Guarding.
(4) Relationship between electricity supply authorities and the Post Office.
(5) More expeditious means for dealing with the diverse views of local authorities and owners and tenants of private property.
(6) Wayleaves, claims and compensation.

Mr. R. C. Andersen, M.C., M.I.E.E., Managing Director, Electrical Transmission, Ltd.

Apart from the added cost of rural electric lines for which the loadings, &c., specified by our regulations are responsible, engineers are faced with the "I can do without" attitude of the agricultural community. This attitude, of course, can only be overcome by the supplier being able to substantiate the somewhat mystical doctrine, that an electric line is cheaper for his customer than no line.

But it will not be cheaper unless it is properly designed; and by this I mean designed as an economic, revenue-bearing unit, and not, like the Tower of London, to stand as a monument for all time. Obsolescence is not just a long word to be whispered secretly by learned pundits of economics. It is a vital factor—particularly in rural line design—through the agency of which it is hoped rural areas will change and develop and become centres of increasing demand.

Such being my view, it would be illogical were I not to find much of our British construction too solid and expensive. The regulations, as indicated, have a bearing on this, but there are also certain constructional details—accepted as orthodox—which might well be discontinued for the sake of economy, and without affecting stability.

Take the case of the conductor. Galvanised steel wire for light loads seems to be taboo. Why? Galvanised steel represents a marked saving over copper, and Mr. W. A. Turnbull, of Aylesbury Corporation, is to be congratulated on using it so effectively.

Wood poles represent another detail worthy of attack. Red fir treated in accordance with Post Office requirements must be specified. Why? Surely larch is quite good enough for rural work; nor need it be treated so expensively. Bearing in mind the rate of expansion for which we have a right to hope, the *economic* life of a rural line should be short.

Insulators represent only a small proportion of the total cost; nevertheless, I hold that there is a tendency to over-insulate rural lines in this country.

I visualise the whole problem of rural electrification as one of detail. Some modification of the Regulations is necessary. On the other hand, our supply engineers should be prepared to accept innovations in their line construction.

Mr. J. Edwin Storr, M.I.Mech.E., M.I.E.E., Consulting Engineer.

Wayleaves.—This subject has been thoroughly discussed in the technical Press, and some attention has been directed to it in the daily newspapers. I venture to say, however, that a great deal more propaganda work is needed to enlighten the residents in the rural areas as to the large proportion of the cost of giving them a supply of electricity due to distribution work as compared with the cost of generation, and further, to effect an appreciation of the economic value of the area occupied by a pole. It is admitted that wayleaves are difficult to obtain, but a much more serious consideration is that of the routes which are now acceptable to the agricultural community. The enormous cost due to the fad of erecting poles in the hedgerows, necessitating angle poles, often of heavy construction because stays must be avoided, does increase the cost of many lines to a serious extent, being as much as twice the cost of a straight-line route.

Enlightenment of the whole community on these aspects of the case, and a realisation of the reasons why the cost of electricity is high, would by force of public opinion soon bring the high-priced landowner and tenant to a more reasonable frame of mind.

It is not that the electricity supply authority wants something for nothing, but just and reasonable terms. The land-worker will avow that he cannot plough within 2 or 3 feet of a pole, and such headlands are often left in the early croppings, but it is remarkable how soon the area uncultivated becomes a matter of how near can the plough be taken to the pole, and the space occupied by the pole becomes the area that would serve for the cultivation of, say, a couple of turnips at, say, 1d. each, whereas the pole brings to a tenant as much as 1s., and the owner oft-times in addition, say, 2s. 6d.

Construction.—It is fully realised that some modification is necessary in the regulations for the erection of overhead lines with respect to the relative importance of the lines when carrying the supply, say, to a small community, as compared with the lines whose failure would throw out of employment even temporarily a large number of works, or where the failure would endanger life.

Further, regarding the cost of British overhead lines, comparisons have been made with cheap rural lines

abroad, but care must be exercised in comparing a line erected for development purposes only against a line in this country which is usually erected as a permanency and to be free from interruptions due to failure.

Standardised work is called for by some overhead-line constructors. This matter, while in itself correct and reasonable, and advisable in due course, would, it is feared, have a tendency to arrest development. It would be of greater advantage, while line-construction practice is in such a state of flux as at the present time, to postpone any rigid standardisation.

Mr. B. G. Drummond, M.I.E.E., General Manager, East Anglian Electric Supply Co., Ltd.

Happy is the engineer who can "deliver the goods" without overhead wires. In rural electrification schemes the difficulties are of a very serious character. They may be briefly summarised under three heads:—

(1) Wayleaves.
(2) Regulations regarding form of construction.
(3) The impregnable position of the Postmaster-General.

1.—As the law stands, the most formidable is the question of wayleaves. The countryside with which the writer is most familiar is East Anglia, where it is highly-cultivated land. It requires very little imagination to appreciate the farmer's objection to having poles erected across his ploughed fields. The question is: what is reasonable compensation to pay the owner, and what can the undertakers afford to pay in sparsely-populated areas? The farmer thinks you are joking when you offer him 1s. per pole per annum. A deadlock therefore ensues, and the Ministry of Transport is asked to hold an inquiry under the 1919 Act. In the meantime no promises may be given as to when the supply will be available. The delay is cumulative in its effect, and seriously handicaps the promoters in securing business. The farmer is not a bad fellow and would, the writer believes, grant the wayleaves if the supply authority were armed with a schedule of rentals for the various classes of land, having regard to their rental value, published by the Ministry of Transport as fixed statutory rentals. It is only in exceptional cases that an inquiry would then be required. When this is necessary the Minister should be in a position to publish his award within three weeks from the date of the inquiry.

2.—The regulations regarding the form of construction are not so serious. The filling-up of Form El. C.34 is tiresome, but it does not present any real difficulty. The cost of the line is more troublesome to deal with.

The writer has little fault to find with the regulations governing e.h.p. lines. It is economic that they should be of first-rate construction, particularly the main lines.

With regard to h.p. and l.p. lines, the regulations will have to be modified to reduce the capital cost. The second comer should bear the cost of guarding in all cases. No guarding should be provided for falling wires—think of trolley wires in our congested towns! The ground clearance should be reduced to 18 ft. except across public highways, where it should be 20 ft. as at present.

3.—As long as the Postmaster-General enjoys his present powers, avoid having questions referred to headquarters. The writer has found the Post Office engineers reasonable men to deal with, particularly if you meet them on the job and settle the matter there and then.

Memorandum T.E.80 is obviously out of date; any reference to it should therefore be avoided. It is highly desirable that legislation should be introduced, giving the supply authorities powers equal to those of the Postmaster-General.

Engineering Organisation.

The functions of the engineer in control should be managerial, his decisions being based on the opinions of his supervising assistants.

[Communicated.]

THE engineer in control of maintenance work—however personally skilled in his art, reasonably familiar with general engineering progress, and temperamentally fitted to control and inspire men he may be—can be only partially equipped to steer a wise and steady course if he is insufficiently informed on the actual success or non-success of the apparatus he is responsible for, or ignorant of the good and bad qualities of the workmen in his department.

It is a true saying that "knowledge is power," that is, real power—the power to decide correctly.

In small positions the engineer is able readily to keep himself fully informed, as he has direct contact with both machinery and staff and is able to utilise his skill and energy to the utmost advantage. In the larger positions, where the territory becomes too wide for this, and the staff too numerous for him to know intimately, he must perforce rely on the statements and opinions of his supervising assistants. If we assume that these assistants are competent, and in possession of exact knowledge by reason of their close contact with the work, and that he personally is not in possession of such information, he is not more fitted correctly to decide the matters at issue than they, and therefore should reserve to himself more the duty of reviewing his assistants' success or non-success in the conduct of their duties, and affording them wise counsel when they explain their difficulties to him.

When he accepts and confirms an assistant's recommendation he accepts responsibility as having judged the recommendation logically and fairly and subjected the proposals to the test of his assumed maturer wisdom.

Where he considers his assistants' success is not great, or their recommendations are apparently unsound, his superior position permits him to withhold his approval, but he must then investigate personally the facts of the case if he expects to deliver a wiser judgment.

As the engineer's position becomes even more extended, and not only are the works under his control many and varied, but his assistants have also their assistants, and so on *ad infinitum*, he finds more and more the need to devote his energies less to engineering detail and more to managerial functions and to correlating the efforts of his assistants if he is to secure successful and harmonious working.

When the occasion arises for his approval or decision to be given, he must needs largely depend on the data and recommendations produced by his immediate assistants, and as they may not be in personal contact with the particular matter, he will be wise to insist on their statements being founded on the exact engineering data furnished by men who are in close contact. To take large decisions or issue instructions which are not so based is to court disaster, because, not only is there great risk in presuming, guessing and theorising on engineering problems, but there is risk of disgruntling the staff and of upsetting the good working of machinery, all of which is akin to folly.

This leads one to take the view that a large engi-

neering organisation—or indeed any large organisation—to be successful and avoid waste, must be built on such lines as will make every person in any position of consequence feel that he is permitted and expected to state his views on any matter he is personally informed upon and competent to judge of. Any person placed over him must receive readily such information and take it into consideration in arriving at a conclusion, only rejecting it if from personal knowledge he finds it inaccurate or unsound. As a practical illustration, let us assume that an engineer has a score of assistants covering a number of sections, and there is reason to consider the failure of some existing machinery, or to consider the selection of new plant and equipment. Let him ask each assistant concerned to advise him on the matter, clearly giving the assistant to understand that, where he accepts the advice, he expects the assistant to accept responsibility. If the assistant's advice appears unacceptable, let him verify the facts before he disagrees, and, if he disagrees, let him explain to the assistant why he does so, and why he thus takes full responsibility This procedure will knit this group of workers into an efficient "band of brothers" and disclose the efficiencies and inefficiencies of each member (including the senior engineer himself!).

No one placed in authority over competent men should put forward recommendations differing from those received without stating so, and giving sufficient evidence of superior personal knowledge of the fundamental facts to warrant his recommendations being accepted.

There is nothing so bad as an organisation which places men in positions of trust and responsibility, and yet does not readily allow of freedom in stating their views on matters within their ken and capacity, and which attempts to operate by the issue of decisions based on insufficient data and out of harmony with ascertainable facts.

The conduct of small businesses is easy compared with large ones, and often accounts for the economy and efficiency obtained. Difficulty greatly increases with the size and extent of the business. The want of success of some very large businesses is common enough to drive one to the conclusion that there is at least the possibility that it may be due to failure to make proper use of the talent and energy in its staff rather than that the staff is incompetent and lazy.

Responsibility for Unclaimed Material.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

IN every trade in which goods are sent to traders for alteration or repair, or as patterns to which new articles are to be made, the question frequently arises as to the rights and liabilities of a trader who has on his hands goods with which he cannot deal, and of which he does not know the owner.

If stock were taken of all the workshops in the country there would doubtless be found hundreds of tons of material lying waste upon the hands of manufacturers and repairers, who do not know what to do with it, cannot utilise it, and cannot return it to the owners, because either the owner is unknown or will not pay carriage for its return. It is extraordinary how some owners of property appear to be entirely neglectful when their goods are left on someone else's hands.

The well-established principle of law that a bailee (or custodian) of goods is bound to take proper care of them hardly applies, for it is not always clear whether a trader in such a case is a bailee or not. If goods are sent to a repairer with instructions for their repair, and the repairer receives the goods and the instructions, there is no doubt that he becomes a bailee, and is bound to take reasonable care of the goods. If the goods are sent with no instructions, the repairer becomes an "involuntary bailee," and there is no duty cast upon him to take any care of them. When goods are sent to a man without his consent, he is not a bailee in the ordinary sense, and is not liable for the loss of the property.

Even when a receipt is given, no liability will be thrown upon the recipient unless the circumstances are such that a contract to take care of them can be implied. Goods for repair mostly come with instructions inside the package, and the repairer cannot know from whom the goods come, or why they are sent, until he opens the package after receipt. It would be intolerable if a person, by merely sending his goods to another unasked, were able to thrust the responsibility of taking care of the goods on to that other person.

Prima facie it cannot be said that by the bare acceptance of goods, a trader makes himself responsible for them; but it might well be said that by setting himself up in business as a person ready to accept such goods, he could not claim that goods had been thrust on to him without his consent. If traders were to refuse to take in every package which arrived without previous orders, their businesses might suffer considerably. A contract to take in goods might therefore be implied in many instances.

It is safer, then, to consider repairers, manufacturers, and other traders, who are in the habit of receiving goods for renewal, repair, or other disposal, as bailees, with the consequent duty to keep the goods in safe custody and to protect them from ordinary loss.

This is all very well up to a point. It is quite easy for a repairer to put the goods aside in a safe place until instructions arrive. This also is true in cases where the trader has received instructions, but cannot execute them, and writes to the owner for further orders. The trader in the meanwhile is bound to look after the goods. But suppose a long interval elapses and no word is received from the owner, what are the trader's rights?

First of all he cannot in any event sell or destroy the goods. Even if they come unasked for, or against his will, he cannot dispose of them as if they were his own. If he is a bailee, voluntary or involuntary, his proper remedy is to demand that the customer shall collect the goods. It is the customer's duty to take back the goods—not the bailee's duty to send them.

In most cases this duty on the part of the customer is impliedly included in the contract for the repairs or renewal. The contract is one, in effect, for repair and re-delivery. So that if A sends goods to B for repair, B, on repairing them, will have to return them and charge A for the carriage. And this is still the case where B receives no instructions—he will be entitled to demand that A shall collect them or pay for their return. And there seems no reason why B should not demand that A should forward the expenses of carriage before the goods are returned.

These principles are very well established in our law. In 1623 it was decided that if a person sends goods to me, and I require him to take them away, and he

refuses to do so, I may have an action against him, "for it is a trouble for me to remove them to him."

It must not be supposed that, because a trader becomes a bailee and answerable for the safety of the goods, he can charge rent for them. The letter that is sometimes sent—"unless you take away your goods in seven days they will be sold to defray warehouse charges"—is, in most cases, quite illegal. Unless there is a contract to pay rent, a bailee has no right to charge it.

It is the duty of a bailee to allow the owner to take away the goods at any time. The bailee, if he has done anything to the goods in pursuance of a prior contract (*i.e.*, has repaired them according to instructions), has a lien or right to retain them until the charges are paid. But even then he cannot charge rent. And if no work has been done on the goods the repairer has no lien and must deliver up the goods on demand.

It is commonly believed that if goods lie warehoused for a long period, and no demand is made for their return, the bailee may dispose of them after six years and claim the protection of the Statute of Limitations. This is not the case, as the following example will show.

The vicar of a certain parish acquired a new set of church plate. The old plate was left in his custody. He sold it as old silver. More than six years afterwards the churchwardens demanded the return of the old plate. On the vicar's failure to produce it, he was sued. He pleaded that the affair was over six years old, and that therefore he was protected by the statute. The Court held that the six years did not commence to run until the demand and refusal had been made. From this case it may be assumed that a trader who has in his workshop old fittings which have never been reclaimed, has no right to scrap them, no matter how long they have been in his possession unclaimed.

Assuming that the recipient of goods is a bailee, his duties are threefold. First, he must take diligent care of the goods, secondly, he may charge no rent, thirdly he must deliver up the goods at any time, however long after their receipt by him. If he is not a bailee, he has none of these duties, except the obligation to let the owner take the goods away.

What, then, should a trader do when he finds his premises becoming stacked up with his customers' old unclaimed material?

He has two courses open to him. He may sue the owner for not taking the goods away, or he may obtain from his customer permission to scrap them or to charge rent for them.

Such permission might be implied from the customer's conduct if, on being requested to take away the goods, he did nothing. A popular way of attempting to avoid the difficulty is for the repairer either to advertise that he will no longer be responsible, or for him to notify the customer by word or letter to that effect. There is some doubt as to the legal efficacy of such a method. If the advertisement or notification reaches the customer and he chooses not to answer and lets things take their course, the repairer will acquire the right to dispose of the goods or charge rent, as the case may be.

But it is not always conclusive that the notification has reached the customer. It is only when the trader can show that the notification or advertisement must have been seen by the owner that he will be safe in disposing of the old material.

It is doubtful whether sending the goods back carriage forward without the customer's express or tacit consent is a safe mode of avoiding responsibility; for if the goods are lost or damaged in transit back to the owner the responsibility will fall upon the trader. He could claim against the railway company, but towards his customer he will have to bear the liability, because, being a bailee, he had no right to put the goods out of his possession into the possession of a third person without the owner's consent.

Economic Progress in Electricity Supply.

A two-part diagram visualising the whole of the charges of the electricity supply industry for one year, or showing the comparison between a number of years, drawn up from the statistics contained in the Electricity Commissioners' Returns.

By D. J. BOLTON.

(*Concluded from page* 813.)

TO find the overall price per kWh which should be charged on these assumptions to a consumer having a load factor of, say, 33 per cent., the annual charge per kW of £13 10s. becomes $13.5 \times 240/0.33 \times 365\frac{1}{4} \times 24 = 1.13$d. which, when added to 0.37d., gives an over-all price of 1.5d. per unit. A consumer who has this load factor and is paying this price per unit can then obtain a complete picture of how his price is made up from a diagram such as the above (p. 812), but for him the figure and scale below the zero line must be reduced to two-thirds of its present size in comparison with the upper part, when the whole is scaled in pence per unit. In a similar way if the load factor is 10 per cent., the correct over-all price should be about 4d. per kWh, and for such a consumer the lower part of the diagram must be rather more than double its present size before it can be added to the upper portion on the existing "energy" scale.

It may be objected that the figures for the kW losses and for the diversity factor have been assumed on insufficient evidence in the Return. If these figures were different, the consumers' load factor would, of course, be changed and the scale of the lower part of the diagram, in £'s per kW per annum, would be altered, but it would still have the same dimensions when scaled in equivalent pence per unit for the consumers' new load factor. Hence it may be said that pictorially the diagram is independent of any of the figures not given in the Return, and were these figures different it would still give a strictly correct impression of the proportions of the two components for the average consumer.

There is one respect, however, in which the diagram may be misleading when one class of consumer is compared with another, even though it is giving an accurate representation of the average consumption. Referring again to the Return, the average overall price paid by lighting and domestic consumers was 5.3d. per kWh, and in order to justify this on the two-part tariff devised above, the load factor would have to be only 7½ per cent. As the average domestic consumer would probably have a load factor considerably above

this, the explanation must be either that such consumers are bearing more than their fair share of the total expenses of electricity supply, or else that the tariff is misleading when applied to an extreme case.

Probably both of these explanations are valid. The individual lighting consumer may be paying too highly, since the decision to employ electric light is not usually determined purely, or even largely, by the cost of energy, whereas the power user has often to be tempted by attractive terms in order to compete with alternative sources of energy.

As regards the second explanation, the power user not only has a better load factor, a point which is covered by the above tariff, but also, on the average, he takes his supply at an earlier point in the system than the domestic user, so that in allocating the costs of transmission and distribution, a greater share should be levied on the low-pressure domestic consumer and a correspondingly smaller amount on the power consumer, this being quite apart from the differences due to their different load factors. This would make no appreciable change in the price per unit, but it would have the effect of increasing somewhat the price per kW of demand for the domestic user and decreasing that for the power user. On such a basis the overall figure of 5.3d. per kWh to the domestic consumer may be justified, even though his load factor is considerably above 7½ per cent.

all three cases, so that exactly the same scales may be employed as before.*

TABLE I.

	1922.	1923.	1924.
Units generated (millions)	4,500	5,230	6,020
Units sold are less by ...	16%	14.8%	15.4%
Fuel cost per unit generated	0.31d.	0.29d.	0.28d.
Fuel cost per unit sold	0.37d.	0.34d.	0.33d.
Aggregate demand on stations (10^6 kW) ...	1.83	2.075	2.298
Excess of receipts over expenses as % of capital	10.0%	9.65%	9.01%
Corresponding total capital charges (10^6 £) ...	15.82	16.80	17.50
Total running costs, excluding fuel (10^6 £) ...	11.27	11.37	12.51
Sum of costs expressed per kW of demand ...	£14.78	£13.58	£13.04
Assumed loss in kW capacity during transmission and distribution ...	12%	10%	10%
Resulting cost to consumer per kW of demand (assuming 1.25 diversity factor)	£13.50	£12.10	£11.50

Fig. 2 shows the three years plotted together on a single diagram, and the progressive improvement at every point is clearly indicated. Whilst this improvement is quite general, it is slightly more noticeable as regards generation than as regards transmission and distribution. The improvement is due primarily to the

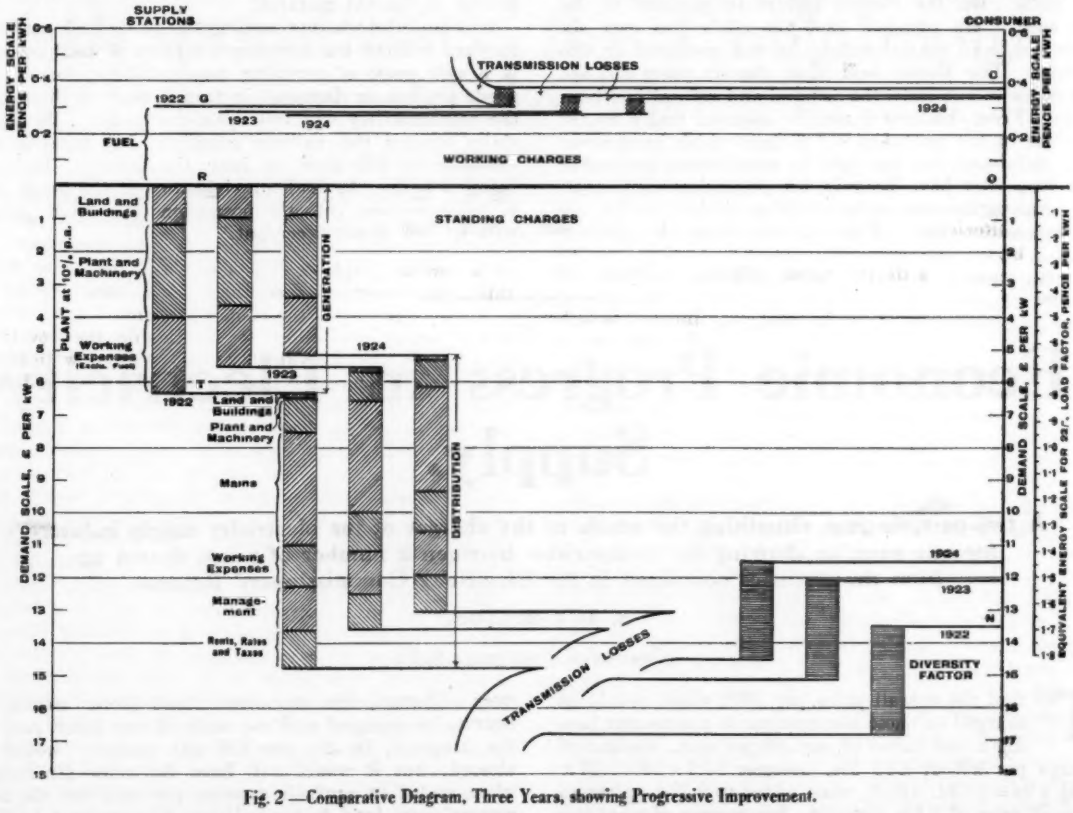


Fig. 2.—Comparative Diagram, Three Years, showing Progressive Improvement.

Having described the diagram, fig. 1, in detail with particular reference to a single year (1922), it will now be employed for the purpose of comparing several different years. As the scales are in price per unit or per kW, the diagram lends itself admirably to such a comparison, as a glance at fig. 2 will show. In the Return which was issued recently the results for 1923 and 1924 were given, and these are treated in exactly the same way as the earlier set of figures, *i.e.*, a two-part tariff is constructed to correspond to the economic data given. The three sets of figures are summarised in Table I, and it will be seen that the same assumptions have again been made, except that as the losses in kWh delivered are less, the assumed loss in kW is also reduced. This has the effect of keeping the average consumer's load factor at 22 per cent. in fact that the output has gone up without a corresponding increase in the equipment cost and running expenses. It is also due, in a slight degree, to a smaller percentage surplus (assigned in this case to capital charges). Another point which the comparative diagram brings out very clearly is that the improvement from 1923-4 was less, not only absolutely, but even proportionately, than the improvement from 1922-3. Optimists will no doubt consider this a proof that we are rapidly nearing perfection!

* This assumes that the whole of the improvement in load factor, from 28 per cent. to 30 per cent. in the three years is to the credit of the undertakings, whereas probably the individual load factors will also have risen to a lesser extent. However, the error, as compared with the assumption made above, would not affect the scale sufficiently to show on the diagram.

Selling Lighting Service.

The New E.L.M.A. Demonstration Rooms.

IN London there are many instructive and entertaining shows to which admission is free, but we consider that few of these can compare with the reorganised Lighting Service Bureau at Savoy Hill, Strand, W.C. Last week we had the privilege of inspecting the premises under the guidance of Mr. W. E. Bush, the manager of the Bureau.

We found that the old reception room had been reconstructed in accordance with the ideas of Mr. H. E. Walker, as outlined in his paper at the E.C.A. Convention last June. This showroom is intended to demonstrate that it is possible, even with limited space, to so arrange the exhibits that the service given by electric lighting can be emphasised, in addition to the artistic merits of the lighting equipment itself. On one side of the room four cubicles, representing domestic interiors, have been arranged, namely, a dining room, kitchen, bedroom and lounge.

Fig. 1.—Cubicles with Appropriate Lighting.

As will be seen from figs. 1 and 2, each interior is suitably furnished, and on the ceiling outside each section a range of suitable lighting equipment for that room is displayed. By means of novel ceiling attachments, any of these fittings can be detached and quickly installed in the cubicle for inspection. In this way the intending purchaser is enabled to concentrate his attention on this unit, which is isolated from the rest of the stock, and the lighting effect which the unit provides can also be critically examined. Around the other three walls interesting demonstration cabinets are provided to keep the interest of a visitor, in the event of the salesman not being immediately available to attend to his requirements. There is a lamp demonstration cabinet which is so arranged that, in addition to displaying a complete range of electric lamps, the number of hours which each lamp will burn for one unit is indicated on an illuminated transparency when the lamp is switched on.

The main lecture theatre has been considerably improved. Several interesting demonstration cabinets have been installed, and one consisting of a motor-car which appears to jolt along a bumpy road when the direction of the light is changed by the operation of a rotary switch, is both amusing and instructive. A very complete display of modern lighting fittings and reflectors is arranged, in order that lighting conditions to suit any commercial or industrial interior can be easily demonstrated.

At one end of the lecture room a revolving house has been erected (fig. 3), which enables the fundamentals of good home lighting to be demonstrated to a large audience. The lighting requirements for each room in the house can be shown in sequence by the operation of a revolving platform. The theatrical effect which this device creates ensures the constant attention of the audience throughout the demonstration.

A model shop window stands beside the revolving house, and every conceivable form of window lighting, from drop cord pendants to superlative colour and spot-light effects, can be presented by the touch of a switch. At the present moment, the special window display, designed by E.D.A. in connection with the National Electric Week, is installed for the inspection of trade visitors. This demonstration window is very useful for showing the various alternatives of coloured lighting which can be produced on the display by means of the spotlights and reflectors which are available. Incidentally, it proves that the Electric Week fit-up (which was illustrated in our last issue) is an excellent

Fig. 2.—Another View of the Cubicles.

Fig. 3.—The Revolving "House."

one, which can be made incalculably more effective by correct lighting.

In a small demonstration room adjoining the lecture theatre, there is an interesting example of daylight lighting through a sub-skylight, provided by means of daylight lamps in reflectors, the effect from which is easily contrasted with real daylight, which can be obscured by means of a dark shutter. It is really difficult to distinguish the artificial light in this room from daylight. Experimental apparatus for showing the reflecting and diffusing properties of various materials used for lighting equipment are also available for inspection and demonstration. On the wall cabinets are fixed which show at a glance the advantages of modern electric lighting compared with older methods.

In another large room many new and interesting lighting demonstrations have been installed. The effects of good lighting are so impressively demonstrated that it would seem impossible for the visitor to remain unconvinced. The latest methods of street lighting are represented by typical lanterns suspended from the roof and controlled from a central switchboard. Two large mobile floodlight display stands accommodate the latest projectors. Illuminated photographs of some modern installations are also available for inspection. On one wall has been fixed a 32-sheet poster, mounted in a well-designed framework, which can be illuminated by various systems of reflectors and floodlights. High up on the background are a number of electric signs, in which the application of all types of coloured lamps is shown. A new type of sign is shown in which gilt letters contain lamps which illuminate the sign background, giving a silhouette effect. One end of the room is divided into three large cubicles, equipped to represent the interiors of a shop, a factory, and a schoolroom. Each interior is realistically furnished and decorated, and so equipped that a contrast between correct and incorrect methods of lighting can be demonstrated. In front of these cubicles, two particularly interesting working models are exhibited, one being a retail shop and the other a factory. The models are made to scale, and the factory, whch has model machines in operation, is illuminated, first, by means of small drop pendants, and secondly, by high-intensity lighting through overhead reflectors.

The *pièce de résistance* is a beautiful model of a nude figure, against a background of a white shell, which is lighted by a number of spotlights, floodlights, and other equipment. The several circuits are controlled by motor-driven flashers, which cause an indefinite number of colour combinations to be projected on the various parts of the display.

The Lighting Service Bureau is continuing its well-known activities in giving lectures to organised groups of visitors. The sixteenth illumination design course, which is now in progress, is being conducted in five centres in London and the provinces, the total attendance for the present course being no less than 450. Recently a party of over 100 L.C.C. teachers were present at the Bureau to hear a lecture by Mr. W. E. Bush on "The Principles of Good Electric Lighting in the Home." A staff of experts is always available to give the fullest information to any individual visitors who care to pay a visit to the Bureau.

The Power Supply of Wireless Sets.

The "battery-less" receiver: some experiences of an engineer who constructed a set which incorporates three thermionic valves with indirectly-heated filaments.

By G. F. J.

FOLLOWING an investigation of the subject of high-voltage anode-battery eliminators,* an attempt was made to determine the practicability of eliminating the low-voltage filament-heating accumulator. It was found that several receivers on the market are intended to operate off the d.c. domestic electricity supply mains, and just a few designed to work off a.c. mains. In the case of the latter, three chief methods appear to have been adopted :—

(i) The use of a small-capacity accumulator combined with a "trickle" charger, so that when the receiving set is switched off the battery is on charge.

(ii) The employment in the receiver of valves of the "point one ampere" class with their filaments connected in series, and supplied with current through a transformer by a gas-discharge (or similar) rectifier valve and a smoothing circuit.

(iii) A third principle involves the use of valves with indirectly-heated cathodes, but at the time of our investigations no receivers using these valves were on the market.

Neither of the first two methods appealed to us to the same extent as the third; as excellent instruction booklets were available, we decided to go ahead with the construction of a three-valve set, using the indirectly-heated cathode principle.

The Valve.—It will be remembered that in the case of the "K"-type valve†, the filament (taking 2 amperes at from 3.5 to 4 volts) is used to heat a cylinder (the cathode) which is coated with the usual metallic oxides for emission purposes. The grid and anode surround this cylinder, which has a connection taken to a terminal on the cap of the valve. The filament, or heater, is fed from the step-down transformer from the mains, and no attempt at smoothing, or rectification, of the heater current is necessary. The impedance of the valve is fairly low (5,500 ohms), but the capacity (inter-electrode) is on the high side, so that, if used as an h.f. amplifier, some form of neutralisation is essential to ensure stability. The characteristics of the valve, however, make it very suitable for l.f. and power-amplification work.

The Circuit.—We selected a detector valve, with reaction, as being suitable for our purpose, and the circuit (O-V-2) is shown in the accompanying diagram. There is nothing freakish about it, the only difference from the standard arrangement being that the earth, h.t.−, g.b.+, and detector grid-leak connections are taken to the cathodes instead of to the filaments. In the particular design considered, an anode battery eliminator was included for the sake of completeness when assembling the set.

The transformer recommended supplies not only the heater circuits, but also the anodes and the filament of the U5 rectifier valve suggested for the h.t. supply. At first we were rather dubious about this point, for the transformer seemed very small to carry a load of about 50 watts; experience, however, has shown no trouble so far in this direction, as the set has been left on circuit

* Elec. Rev., June 10th, 1927; p. 921.

† Elec. Rev., January 28th, p. 158, and April 8th, p. 578, 1927.

continuously over a week without any appreciable heating resulting therefrom.

The anode supply, after rectification, is smoothed by means of a power choke, and two 6 μF banks of Mansbridge condensers. The detector tapping is arranged through a variable resistance ("Bradleyohm") of from 10,000 to 100,000 ohms, giving from about 10 to 65 volts variation. The amplifier voltage at full load is somewhere about 100 V.

We made no pretence of making a show job; the parts were assembled on a baseboard, while a wooden panel carried the tuning condenser and reaction unit.

Experience.—The first snag we came up against was the valve holders. We used the best type of anti-microphonic holder obtainable, but found that the sockets did not grip the valve legs sufficiently to ensure a good contact suitable for carrying 2 amperes. Accordingly, we exchanged them for a set of rigid holders, which were a tight fit, with marked success. A similar point cropped up in connection with the rheostats: our local wireless

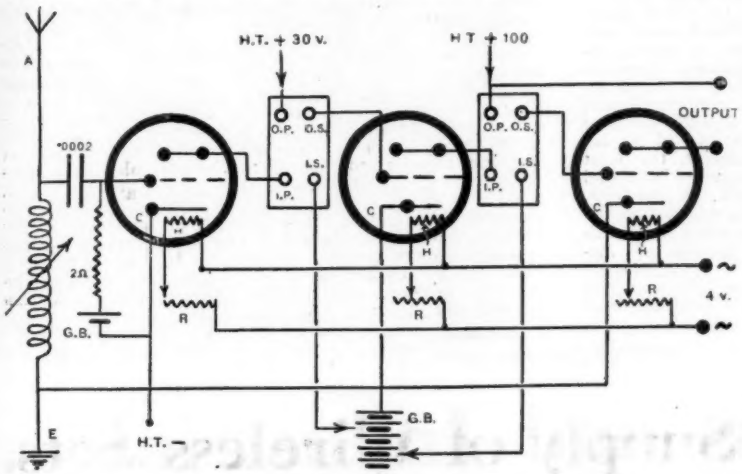


Fig. 1.—A Satisfactory Receiver Circuit incorporating three "K"-type Valves.

shop had nothing capable of handling more than 1 ampere, and we had to resort to a set of rheostats of the sliding type, on a slate former, such as is used for varying the output of accumulator-charging plant.

In passing, individual control of each valve appears to be essential for best results. As an experiment, we ran all three valves from one rheostat, but found that while one cathode had a barely visible glow, the second one was a dull red, and the third slightly brighter. Apparently this was due to slight differences in centralisation of the heater wire in the cathodes.

Tests.—When the above-mentioned minor points had been disposed of in a satisfactory manner, we proceeded to the test of the set. One minute after switching on the supply, the speaker began to sound "live," and we were able to tune the local station. It was found that a very small amount of reaction would cause the set to oscillate, so the reaction coil was replaced by a shorting link. After adjustment of the rheostats and grid bias, the volume and quality were very satisfactory from the local main station (38 miles) and Daventry (100 miles). Full volume is not attained until about two minutes after switching on, and there is a corresponding "time lag" when making adjustments to the rheostats, which is slightly confusing at first.

There appeared to be a complete absence of such noises as crackling and hum from the speaker, but there is a slight hum from the transformer when in circuit; this, however, is not objectionable, and if the mains unit were enclosed would probably be inaudible. The valves appear to run very warm but, strangely enough, the rectifier is hotter than the receiving valves after a five- or six-hour run. Any containing cabinet, therefore, must be well ventilated, otherwise overheating will certainly occur. It was found that rather more negative grid bias is necessary than for standard valves, while the detector appeared to relish a slight positive bias (about 1.5 V). In the case of the third valve, 15 volts negative was not found excessive, while the second worked best with 12 V.

A curious trouble was experienced when the amplifier cathodes, particularly the first, were allowed to run a shade hot. It took the form of a mixture of a howl and an open-grid effect, the result being rather reminiscent of a bubbling sound; when the temperature of the cathodes was reduced, however, the defect disappeared. The most efficient results were obtained with the first two cathodes running at a barely visible glow, and the third at a dark cherry red. Once this adjustment was found, the rheostats were clamped tight, and have not yet been disturbed since. The high internal capacity of the valve causes a certain amount of "natural reaction," and the set will oscillate if the detector voltage be slightly increased (usually it is run at about 30 volts); the reaction coil was, therefore, discarded.

Conclusions.—The receiver has been used for nearly six months as a "service" set for the household, and is in use for 8 hours daily at least. So far, no attempt has been made to use it as a distance receiver, but purely to give really good results from two stations. It is a particularly fascinating set, and later on we intend to rebuild it in cabinet form, so that it will look as good as it sounds.

There appear to be distinct possibilities for the future in this direction. Hospitals which would like an installation of some kind, without the trouble of recharging batteries, will find the solution of their problem in the indirectly-heated cathode valve. As regards running costs, it is rather difficult to compute them completely without knowing the life of the valves, and so far they have not been on the market very long. Those under consideration have lasted over 1,000 hours without any sign of a diminution of efficiency. It is not unreasonable to suppose that they will last for at least a similar period longer, and probably more. The consumption of the set, judged by timing one revolution of the supply meter, is 60 watts exactly, so that the cost of energy will not be heavy.

The "Osiso."

A new method of teaching the deaf to speak which promises to simplify that extremely difficult task is being put to a practical test in a series of experiments conducted at the Western Pennsylvania School for the Deaf, in Edgewood, Pennsylvania, U.S.A. The new method is known as "voice vision," and is based on a recent invention which presents the voice in a visible form by transforming sound waves into light waves. The teacher speaks a sustained note, such as "ah" or "oh," into a telephone receiver attached to the "Osiso," and the child watches the path of the light waves, and, by experimenting with his voice, soon reproduces approximately the same picture as the teacher, which means approximately the same sound. The "Osiso" is the invention of Mr. Joseph W. Legg, an engineer of the Westinghouse Electric and Manufacturing Company. When sound waves strike the diaphragm of the receiver, currents of exactly the same frequency are set up in an electric circuit, causing a small mirror to vibrate, with the result that a narrow beam of reflected light traces a path similar to the wave-form of the sounds; by means of a rotating polygon of mirrors, the light wave is made to appear in the form of an unbroken wave.

Machine Speeds and Output.

A PAPER read by Mr. F. Wyatt before Section J—Psychology, at the Leeds meeting of the British Association—dealt with the question of machine speeds and the ability of the operatives to keep pace with them. In the case of machines running at a fixed speed, the author said the rhythmical nature of the mechanical movements tended to impose a similar reaction upon the operative. Theoretically, he or she was expected to maintain a constant and regular rate of working throughout the day, and to behave almost as mechanically as the machine itself. The living organism, however, was a vastly different structure from a machine, and was subject to very different laws. It was highly probable, therefore, that the operative might be imperfectly adjusted to the requirements of the machine, or *vice versa*.

Laboratory experiments were carried out in which the subjects submitted themselves to tests in which the speeds of machines were varied. The lower speeds were found to be objectionable because of the limitations imposed by the machine. Each subject expressed annoyance at the restricted conditions of work, because of the thwarted desire to spurt at certain periods during the test. Secondly, the higher speeds were usually found to be conducive to increased strain and fatigue. Failure to keep pace with the beats of the metronome (with which the speed was controlled) was often disturbing, and the consequent raggedness in the rate of working reduced the pleasure associated with the more rhythmical nature of the work at the medium speeds. Thirdly, the most productive and enjoyable speeds varied in the case of the different subjects. From the industrial standpoint, the most important feature of the results was the existence of individual differences in the ability to keep pace with the machine. Either the speed of each machine should be adjusted to the natural rate of working of the operative, or workers of approximately equal ability should be selected for the task. All mechanically controlled speeds would, however, be imperfectly adapted to the natural rate of working of the operatives because of the variations in working capacity at different times during the day. Since, however, in practice the majority of machines were made to run at a constant rate, the varying capacity and inclination of the worker must always be sacrificed to a certain extent to the requirements of the machine. At the same time, a more definite recognition of the existence of individual differences in ability and a sincere attempt to adjust these differences would be an important advance towards securing greater harmony in this feature of industrial work.

Later, experiments were carried out in a factory in which operatives were engaged in feeding machines. A preliminary survey suggested that the productive capacity of the operatives was restricted by the speed of the machines. In most cases the operatives seemed to have no difficulty in keeping the machines fully supplied with material, and it appeared that a higher rate of working would have been well within their power. This was supported by work-curves, and there was no doubt that the productive capacity of the operatives, and consequently the welfare and interests of the firm, were seriously impaired by the unnecessarily low speeds of the machines. A number of tests were made to ascertain the effect of different machine speeds on productive activity These indicated that the operatives were usually unable to approach their maximum rate of working because of the limitations imposed by the speed of the machines. It was quite common to find differences in efficiency amounting to 30 or 40 per cent. in repetitive handwork, where working capacity could be fully expressed in productive activity. In the investigation described, the operatives of superior ability were practically reduced to the level of the least efficient workers because of the limitations imposed by the speed of the machines. By suitably increasing the machine speeds there was little doubt that the productive efficiency of the process could be increased by from 10 to 15 per cent. without increasing the fatigue or discomfort of the operatives. Ideally, the speed of the machines should be arranged so that they constituted a progressive series. Under such an arrangement novices, during the early stage of the learning period, could be assigned to the slowest machines, and promoted progressively to machines running at higher speeds until they eventually arrived at machines having a speed which harmonised with their final rate of working. Individual differences in ability would in consequence be adequately expressed in productive efficiency, and each operative would be most comfortably and effectively employed.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A. Circle Campaign.

In addition to those mentioned in our last issue, the following municipal undertakings have agreed to supply free electricity to electrical contractors' windows employing the special window display during National Electric Week (December 3rd to 10th):—Risca, Sunderland, South Shields, and Tynemouth. The number of supply undertakings and contractors co-operating and exhibiting the window display is now 500. A number of important newspapers have promised to publish special electrical pages during the Week. Contractors in Whitley Bay, Tynemouth, and South Shields are combining to rent and arrange displays at vacant shops in these districts. Ten of the twelve South Shields showrooms are using the window display, and the electrical engineer recommends that free additional energy shall be supplied. Demonstration houses or exhibitions have been opened at Tamworth, Spalding, Harrogate, and Bath, making the total to date 58. Further speakers have been enrolled in the Lecture Panel.

The Boston (Lincs.) Circle is organising an electrical exhibition, which will be held in Shodfriar's Hall, Boston, from December 6th to 10th, 1927. Every branch of electricity will be catered for, and an all-electric house will be a feature.

Continuing its efforts to stimulate interest in the campaign in its area, the Shropshire, Worcestershire and Staffordshire Electric Power Co. has erected a number of hoardings in various districts bearing the company's monogram and the slogan "For Health's Sake Use Electricity." We have received photographs of one of these, and also of a window display at the company's Bromsgrove showroom depicting in an attractive fashion an electrical fireside scene.

Norwegian Electrode Production.

The report for 1926-27 of the Norske A.S. for Elektrokemisk Industri states that the business in electrodes has made such progress that this branch of activity now preponderates. The business is distributed over the world, and covers most countries where electric smelting is carried out. Since last year 15 new works have been added so that there are now installed or in course of installation 164 furnaces with a total capacity of 525,500 kW. The use of the company's electrode system has progressed in the past year in the aluminium industry, but the development in this branch must still be considered to be in its initial stage. Nevertheless there are now in operation or process of installation in Europe and America about 25,000 kW with Soderberg electrodes, corresponding to an annual production of about 8,000 tons of aluminium.

Marking Imported Wire.

Following recent inquiries by the Board of Trade Standing Committee, a draft Order-in-Council has been laid before Parliament providing, *inter alia*, that iron and steel wire shall be marked with the name of the country of origin upon importation and upon sale when it is re-wound or re-coiled.

The Order also covers certain brass water fittings, but brass electrical fittings which were dealt with at the same inquiry are not mentioned.

Registered Electrical Contractors.

We have received from the National Register of Electrical Installation Contractors, 1, Lincoln's Inn Fields, W.C.2, a list of the names of contractors upon the register on April 1st, 1927. A supplement containing additions and deletions accompanied the booklet. The contractors are shown under the names of towns, which are arranged alphabetically.

The following applications for registration were accepted by the Executive Committee on November 11th:—Robson, T. V., Sunderland. Dickinson, S., Manchester. Gallagher Bros., Dublin. Vass, A. L., Stoke-on-Trent. At the same meeting one application was withdrawn and five were declined.

Whitley Councils Bill.

At a recent meeting of the Association of National Joint Industrial Councils it was decided to proceed with the Whitley Councils Bill which would give a Council the option of securing the enforcement throughout the industry of any of its decisions with regard to which it made formal application to the Minister of Labour. The chief object of the Bill, it is stated, is to stop payment of sweated wages and consequent price-cutting by minority employers who are unorganised and not represented on the Council in their industry. It is emphasised that agreement between the two sides of a Whitley Council would still be voluntary, and that the Minister of Labour could make no order without consultation and agreement with the Council. It is understood that an effort will be made to introduce the Bill during the current session of Parliament.

New Ilkley Showrooms.

Reference was made in our last issue to the opening of new showrooms by the Electricity Department of the Ilkley Urban District Council, and we are now able to reproduce a photograph of part of the interior of the premises which we have received from the engineer and manager, Mr. E. J. Jarvis. As will be seen, an attractive and uncrowded display of lighting fittings and domestic appliances has been arranged

The New Ilkley Showrooms.

in this apartment. There are also a number of cookers, water heaters, &c., on view, and in two large front windows are arranged vacuum cleaners, a washing machine, &c. At the opening ceremony, by Alderman W. Walker (Central Electricity Board), remarkable figures of electrical progress in Ilkley were quoted. Development is fostered by a reasonable two-part tariff.

Our Foreign Electrical Trade.

The following were the values of imports and exports of goods and machinery during October:—

	October, 1927.	Inc. or dec. as compared with October, 1926.	Ten months, 1927. Inc. or dec.
Imports.			
Electrical goods and apparatus	£ 464,550	£ + 80,202	£ + 385,318
Machinery	1,244,073	+219,911	+2,612,642
Electrical machinery ...	143,147	+ 48,779	+ 403,817
Exports.			
Electrical goods and apparatus	937,836	−212,749	− 290,512
Machinery	4,503,333	+547,477	+2,497,632
Electrical machinery ...	540,161	+ 5,904	+ 893,350
Re-exports.			
Electrical goods and apparatus	16,658	+ 329	− 26,759
Machinery	117,565	+ 14,313	+ 78,189
Electrical machinery ...	10,341	+ 5,618	+ 20,417

Licensing of Electricians in N.S.W.

Under the Contractors' and Electricians' Licensing Act recently passed by the New South Wales Legislature all persons engaged in electrical installation work must be in possession of a licence, the fees for which are £2 for contractors and 5s. for electricians. Applicants for licences are required to produce satisfactory evidence of their qualifications.

Hire-Purchase Installations.

Apropos our recent report of Mr. W. H. Webbe's address on "Hire Purchase" (ELEC. REV., November 4th, p. 793), Mr. Harry Moss, of Bradford, informs us that he has had in operation for over eighteen months a hire-purchase system for electrical installations. Generally speaking, he requires a deposit of 20 per cent. of the total cost, and 10 per cent. is added to the balance which, as a rule, is arranged to be paid off in five or six months. The scheme is confined to owner-occupiers, and Mr. Moss says that it has greatly stimulated business, and from a financial point of view is very successful.

Municipal Electrical Trading.

The Lincoln Tramways and Electricity Committee received a deputation recently from the Lincoln Sub-Branch of the Electrical Contractors' Association in connection with the exercise by the Council of the powers conferred on local authorities by Section 48 of the Electricity (Supply) Act, 1926, for the sale of fittings, apparatus, and appliances, and for carrying out installations on consumers' premises. The deputation requested the Committee to enter into an agreement with the contractors as to the allocation of discounts on sales from showrooms and other sources on similar terms to those of the agreement made with the parties before the passing of the Act. The Committee promised to consider the matter.

French Tariff Increases.

The November *Bulletin* of the British Chamber of Commerce, Paris, contains tables showing how the increased "minimum" French Customs tariff, which came into force in September, will affect British imports. Under the heading "Dynamo-electric machines and industrial transformers, dry or in oil," the increase rises as the weight of the articles falls. Thus for 3,000 kg. or more the increase is from 1.22 to 1.50 fr. per kg., while for articles weighing less than 5 kg. the rise is from 6.72 to 20 fr. per kg. The same rule applies to unspecified electrical and electrotechnical apparatus and to meters.

Buell Combustion Patents.

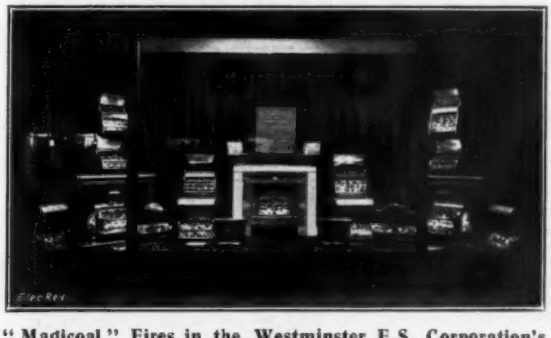
The directors of the Buell Combustion Co., Ltd., state that they have completed negotiations for the sale of the foreign rights of the Buell patents on very favourable terms. An agreement has also been made with shipping interests for the application of the patents to marine boilers.

The British Industries Fair.

The *Board of Trade Journal* states that the response which the Department of Overseas Trade is receiving to the series of special letters which it has addressed, or is addressing, to thousands of known buyers all over the world is more than satisfactory; in fact, every indication supports the view that the attendance of overseas buyers at the forthcoming Fair will surpass all previous records. Applications from exhibitors for the entry of their name and a description of their exhibits in the special advance edition of the catalogue of the London section of the Fair are being received in increasing numbers. Ten thousand copies of the advance edition of the catalogue will be circulated abroad two months before the opening of the Fair, a special step which it is improbable is undertaken by the organisers of any other great trade fair in the world. The circulation overseas of the advance catalogue of the last Fair secured not only valuable publicity for the exhibits of individual exhibitors, but resulted in the receipt of numerous inquiries addressed to exhibitors before the Fair actually opened, and also of actual orders.

A "Magicoal" Display.

The illustration herewith depicts the new showroom window of the Westminster Electric Supply Corporation, Ltd., in Victoria Street, S.W. The whole of the window is draped



"Magicoal" Fires in the Westminster E.S. Corporation's Window.

with black material, and blue floodlighting is used which has a very striking effect upon the steel of the grates, and forms a very beautiful contrast with the "Magicoal" fires which comprise the display.

A Light Episode.

Messrs. PHILIPS LAMPS, LTD., state that they recently received the following communication from a customer in a remote part of the country to whom they had sold a 100-W lamp:—"Dear Sir I receved your lamp but I can not get any light from it as you did not send any instructions how to light it nor to re fill it please send same and oblidge ypurs truly."

Unemployment.

There was an increase of over 32,000 in the number of unemployed during the week ended October 31st. At that date the total was 1,106,100, as compared with 1,074,090 on October 24th, and with 1,559,240 on November 1st, 1926 (coal dispute period).

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The Timber Trade.

Our Timber Trade Correspondent reports that European building timbers of all descriptions have been imported on a very large scale, greatly hindering the relief of the congestion at docks occasioned by previous large shipments. The large stocks on the market and the difficulties of getting goods freely from quays to storage have had the effect of upsetting the market, and prices are weaker, although expected to move up when docks are once more normal. Building trade orders have tapered off, but there is promise of revival. Hardwoods from the States are in plentiful supply, and prices unsteady, but likely to rise. On the other hand, mahogany in the log is in low stock with values strong for the better grades. Teak, satinwood, lignum vitæ, and other tropical hardwoods also are very firm in value, with stocks moderate to low. There is fair inquiry for Empire woods, especially Douglas fir and other British Columbian woods, for which prices are moderate considering their usefulness and quality. Plywood is plentiful with a fairly good demand.

The Manufacture of McClary Cookers.

In our issue of May 27th last we reported that Messrs. Berry's Electric, Ltd., had secured the sole British manufacturing and selling rights of the McClary (Canadian) electric cooker. At the same time we illustrated the half-finished factory extension which the company was making to deal with the business. We are now able to reproduce a view of the finished works, which shows the rapid progress that has been made in six months.

Factory for McClary Cookers.

Recent Contracts.

The Electric Furnace Co., Ltd., has recently received orders for five "Ajax-Wyatt" furnaces for the Compagnie Générale des Métaux, Serrifontaine, France, and two for the Société d'Electrométallurgie de Dives. The company has also just shipped six "Ajax-Wyatt" furnaces to the Tréfileries et Laminoirs du Havre, France. Each of these furnaces is of 600-lb. capacity, and is required for melting brass. Another recent order is one for a 150-kVA "Ajax-Northrup" high-frequency furnace for steel melting from the S.A. Commentry-Fourchambault & Décazeville, Imphy, France, and the company is now erecting a similar furnace for S.A. des Etablissements Jacob Holtzer, Unieux. These furnaces, which are of the same type as that recently started at the works of Messrs. Edgar Allen & Co., Ltd., Sheffield, are each of 450-lb. capacity, and are to be used for melting steel.

The Electrical Contractors' Association.

At the last meeting of the Council of the Association thirty-five new members were admitted to the Association. The total membership is now approximately 1,050. New Association activity was reported at Torquay, Exeter, Chesterfield, North Wales, Eastbourne and Hastings. The names of the winners of the E.C.A.'s gold medal and £20, silver medal and £20, and bronze medal and £10, given annually to successful apprentice competitors in the City and Guilds of London Final and Grade 1 Examinations, have already been published. Four "Sectional" awards of £5 each have been made to apprentices in the employ of Messrs. Turner, Epsom, Messrs. Webb, Leicester, Messrs. Smith & Croft, Bradford, and Messrs. Booth and Bomford, Cardiff. In the 1927 examinations, 261 apprentices sat for Grade 1, 44 obtaining a first-class pass and 72 a second-class pass. In the final examination, 71 sat, 7 obtaining a first-class pass and 18 a second-class pass. The late president of the E.C.A., Mr. H. J. Miles, M.I.E.E., was elected a fellow of the Association. It was reported that the Electrical Contractors' Association had undertaken to provide the labour required in connection with the wiring of the new offices and club room of the Electrical Association for Women at Kensington Court.

The annual dinner of the E.C.A. will be held at the Trocadero, W., on January 17th. The annual conference will be held during the summer of 1928 in the Middle West. In this connection the possibilities of Cheltenham are under consideration.

The annual dinner of the Manchester Branch will be held on November 30th, and that of the Newcastle Branch on December 1st.

Local Exhibition.

Bradford.—The Corporation Electricity Department had an attractive display of electric cookers, heaters, kettles, and other domestic appliances, including lighting and general heating equipment, at a Trades and Labour-Saving Exhibition held recently at the Belle Vue Drill Hall.

Great Britain's Radio Exports.

Figures published by the *Wireless Trader* show that the total value of exports of radio apparatus from this country during September was £95,892, including valves valued at £16,914. Japan was by far the most important customer, her share amounting to £30,047 (valves £7,697). Australia took second place with £12,880 (valves £3,437), and the Netherlands was third with £7,448 (valves £50). Other important customers were: India and Burma £7,795, France £5,261, and Italy £3,776.

German Price Increases.

It is announced that as from November 1st the German firms have increased the prices of generators, transformers, switchgear, and installation material by 5 per cent. as a result of the rise in production costs. The prices of meters, measuring instruments, and h.p. cables, which were recently advanced by 3-5 per cent., remain unaltered, although a further revision in this respect in the near future is considered possible.

The Aluminium Market.

The reduction of the price of aluminium in the United States from 26 to 25 cents per lb. or about £115 per ton, has attracted some attention in Germany. The price concession is regarded more as an effort to stimulate the market in the United States, which is quiet at present, than as a measure against the European Aluminium Syndicate. At the same time the new American price will render it all the more difficult for European makers to export to America, where there exists an import duty of about £23 per ton, with the addition of about £1 per ton for freight and insurance from Europe. On the present basis it would therefore be necessary to arrange for a price of about £90 per ton to have any chances of success in exporting to that market. The Germans are not particularly concerned with exports to that destination, but the French were suppliers before the recent price advance. The present price of about £104-£105 per ton in Europe is said to be remunerative.

Trade Announcements.

The telephone numbers of the Omega Lampworks, Ltd., are now Wimbledon 5235 and 5236.

Premises have been opened by Mr. H. Gilbert, radio engineer, at 139, Yorkshire Street, Oldham.

Messrs. Hick-Hargreaves & Co., Ltd., Bolton, have secured the British manufacturing rights of Mason's valves with the patents, and are proceeding immediately to manufacture them. The valve will be known as the "Hick-Mason" valve.

Messrs. Craig, Munn & Co., electrical and wireless engineers, on November 5th opened new premises at the Broadway, Douglas, Isle of Man.

Premises at 38, Regent Street, Cambridge, have been opened by Currys (1927), Ltd., wireless dealers.

New Catalogues and Lists.

Automatic & Electric Furnaces, Ltd., North Road, Holloway, N.7.—An illustrated pamphlet dealing with the company's latest furnaces.

Messrs. Reavell & Co., Ltd., Ranelagh Works, Ipswich.—Pamphlet No. 154, illustrating and describing the company's high-speed single-stage quadruplex air compressors.

Mr. Paul Dieny, Southampton House, 317, High Holborn, W.C.1.—An illustrated booklet dealing with the "Frisch" lubricator.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publications No. 990, illustrating and describing the company's light-weight traction motors, and No. 993, dealing with the "Seewer" governor gear for impulse water turbines.

Messrs. Blackstone & Co., Ltd., Stamford.—Publication No. 426, an illustrated booklet describing the company's petrol engines—from 2 to 5 h.p.

Higgs Motors, Witton, Birmingham.—November-December stock list of a.c. and d.c. motors and a priced and illustrated leaflet dealing with battery-charging sets.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Publication F4490, containing eighteen illustrations of factories, offices, shops and shop windows, to show the application of G.E.C. lighting systems in many directions.

British Insulated Cables, Ltd., Prescot, Lancs.—Publication No. P.224, advertising "Prescot" anti-acid varnish for the protection of exposed wires and metal work.

The Sloan Electrical Co., Ltd., 8, 10 & 12, Golden Lane, E.C.1.—A 128-page catalogue of electrical materials, accessories and appliances, including domestic devices. Fully illustrated and priced.

Messrs. Frederick E. Potter, Ltd., Imperial House, Kingsway, W.C.2.—A brochure dealing with the company's advertising service and containing many reproductions of examples of its work. A number of letters of appreciation are also included.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A very comprehensive catalogue (152 pp.) containing illustrated particulars and prices of radio receiving sets, components and accessories of many makes. Also a pamphlet advertising "Yale" flashlights and batteries.

ELECTRICAL EQUIPMENT & CARBON CO., LTD., 109-111, New Oxford Street, W.C.1.—Monthly stock list of motors, dynamos, carbons, cables, &c.

MESSRS. FALK, STADELMANN & CO., LTD., 83-93, Farringdon Road, E.C.1.—Catalogue No. 601, containing illustrated particulars and prices of vellum shades and standard lamps.

LIGHTING TRADES, LTD. (incorporating J. & W. B. Smith, Ltd.), 30-31, Farringdon Street, E.C.4.—Electrical accessories catalogue for 1927-28, containing illustrated particulars and prices of lampholders, switches, fuses, plugs and sockets, adaptors, flexibles, cables, bells and accessories, lighting fittings, conduits and fittings, &c.

MESSRS. POYNTER, GRIFFITHS & CO., LTD., Canonbury Road, N.1.—A folder containing prices of many types of "Maxim" filament lamps.

MESSRS. ELLIOTT BROS. (LONDON), LTD., Century Works, Lewisham, S.E.13.—A number of additions to the company's sectional catalogue dealing with d.c. controller instruments, leakage indicators, frequency meters, power-factor indicators, galvanometers and tachometers. Fully illustrated and priced.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 180, containing very full particulars, illustrations and prices of "Siemens-Xcel" domestic electrical appliances, including many patterns of cookers and fires.

MESSRS. J. W. JACKMAN & CO., LTD., Vulcan Works, Blackfriars Road, Manchester.—A brochure on the cleaning of metallic articles, describing the company's sand-blast equipment, including complete movable cleaning rooms.

Bankruptcy Proceedings.

EDWIN PRITCHARD, Dudley Road, Wolverhampton, Staffs., electrician.—The receiving order in this matter was made on debtor's own petition. The first meeting of the creditors was held recently at the Official Receiver's office, 30, Lichfield Street, Wolverhampton. The case, being a summary one, was left with the Official Receiver as trustee of the estate.

C. R. W. ROWED and A. E. SMITH (Rowed & Smith), electrical engineers, 1, Alexandra Road, Ellacombe, Torquay.—Receiving order made November 2nd, on debtors' own petition.

P. W. WITHAM, electrical engineer, 139, Bournemouth Road, Parkstone.—Receiving order made November 4th, on debtor's own petition. First meeting held November 18th. Public examination December 7th, both at the Law Courts, Bournemouth.

H. L. SMITH, electrician, 10, Ordell Road, Bow.—Last day for proofs for dividend November 26th. Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C.

G. C. BARNES (Regent Electrical Works), electrical engineer, Royal Street, Barnsley.—Trustee, Mr. B. S. Briggs, 21, King Street, Wakefield, released November 3rd.

E. D. S. MUNDAY, electrical engineer, 272, Lake Road, Portsmouth.—Trustee, Mr. H. Ashton, Official Receiver, 87, High Street, Portsmouth, released October 28th.

H. L. WOOD, electrical engineer, late of Elm Grove, Southsea.—Trustee, Mr. H. Ashton, Official Receiver, 87, High Street, Portsmouth, released October 28th.

J. F. FAULKNER and A. E. FAULKNER (J. F. & A. E. Faulkner), wireless dealers, &c., 20, Market Street, Penistone.—Last day for proofs for dividend November 26th. Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield.

O. WALKER (Albion Electric Co.), electrical contractor, 112, Albion Street, Wallasey.—First and final dividend of 1¼d. in the £, payable November 21st, at the Official Receiver's offices, 11, Dale Street, Liverpool.

Company Liquidations.

S. E. WHITELEY, LTD., 54, Gartside Street, Manchester, dealers in radio goods, &c.—A meeting of creditors was held on November 3rd, when a statement of affairs was submitted which disclosed liabilities of £15,396 and net assets of £8,516, leaving a deficiency as regarded the creditors of £6,880. The company was registered in May, 1920, with a nominal capital of £12,400, consisting of 10,000 preference £1 shares and 48,000 1s. deferred shares. It had issued 1,700 preferred shares and the whole of the deferred shares. From time to time 6,740 further preferred shares had been issued, but not all for cash. In the first year there was a profit, but there had since been losses. Mr. Charles Latham, 78, New Oxford Street, W.C., was appointed liquidator, the present liquidator, Mr. J. G. Coates, agreeing to resign from the position. A committee was appointed consisting of representatives of the Dunlop Rubber Co., Ltd., Metropolitan-Vickers, Ltd., and the Chloride Electrical Storage Co., Ltd. The following are creditors:—

	£		£
Robinhood Engineering Works, Ltd.	129	Goodyear Tyre & Rubber Co. (Gt. Britain), Ltd.	175
Michelin Tyre Co., Ltd.	283	General Electric Co., Ltd.	187
British Goodrich Rubber Co., Ltd.	248	Chloride Electrical Storage Co., Ltd.	251
Lodge Plugs, Ltd. ...	167	Philips Lamps, Ltd. ...	230
Fisk Tyre Co., Ltd. ...	261	Dunlop Rubber Co., Ltd.	630
K. & S. Supreme Rubber Co.	143	Lucas, J., Ltd.	106
Cryselco, Ltd.	231		

IMPROVED ARC WELDING CO., LTD.—Winding up voluntarily. Liquidator, Mr. S. H. Clinch, 119, Moorgate, E.C. Meeting of creditors November 25th, at the liquidator's offices. Particulars of claims to the liquidator forthwith.

Private Arrangement.

A. F. GOODWIN & CO., 28, Minories, E.C., manufacturers and electrical engineers.—A meeting of creditors was held on November 11th at the offices of Messrs. Hicks, Arnold and Bender, 25, Southampton Street, W.C., when the representative of the Sloan Electrical Co., the largest unsecured creditors, presided. A statement of affairs was presented which disclosed liabilities of £916, and total assets of £670. The solicitor said that a gentleman was interested in the matter and he was prepared to give the sum of £70 for part of the stock, provided arrangements could be made with the unsecured creditors. He would be willing to continue the business and pay the debtor a salary. The debtor would also participate in any future profits. If no satisfactory arrangement could be arrived at the matter would have to be dealt with under a deed of assignment or in bankruptcy. The present position was attributed to heavy losses on two Government contracts. The turnover during 1924 was £10,688, but in the following years it had gradually declined until for the year 1926 the sales were £6,870, and for 1927 the sales were only £1,400. The solicitor offered a composition of 7s. 6d. in the £, payable as to 2s. 6d. down, 2s. 6d. in three months, and 2s. 6d. in six months. The debtor's brother offered to guarantee the last instalment, and it was decided therefore to accept the composition. The following are creditors:—

	£		£
General Electric Co., Ltd.	80	Edison Swan Electric Co., Ltd.	29
Imperial Lighting Co., Ltd.	66	Falk, Stadelmann & Co., Ltd.	20
Hackbridge Cable Co., Ltd.	24	Sloan Electrical Co.	199
Philips Lamps, Ltd. ...	35	Johnson & Phillips, Ltd.	50

Dissolutions of Partnership.

SUPER RADIO CO., wireless dealers, 2, Bank Street, Bradford, and 27, King Street, Nottingham.—Mr. B. Freeman and Mr. F. S. Freeman have dissolved partnership. Mr. B. Freeman will attend to debts and continue the business on his own account at Bradford and Nottingham. Mr. F. S. Freeman will continue in business under the same style at 104, Dale Street, Liverpool.

CONDRY & HARRIS, electrical engineers and contractors, 43, Bell Barn Road, Birmingham.—Mr. H. J. Condry and Mr. B. Harris have dissolved partnership. Mr. Harris will attend to debts and continue the business in his own name.

New Municipal Showrooms.

The Gravesend Corporation Electricity Committee has recommended the acquisition of premises in Stone Street for the purpose of electricity showrooms.

Australian Electricians' Claims.

The Australian Electrical Trades Union has served upon employers in all States, except Queensland, a claim for increased wages for its members; the establishment of an apprenticeship board for the placing of boys in industry according to the vacancies existing; and for other improvements in conditions.

Swiss Locomotives for Spain.

We recently reported that Brown, Boveri & Co., Switzerland, had received an order for two trial express locomotives for the Spanish Northern Railway. This order has been increased to twelve locomotives, which are to be used for hauling the express trains on the Irun-Alsasua section of the line.

Zanzibar Tariff Increase.

The *Board of Trade Journal* states that the *ad valorem* duty on goods imported into the Zanzibar Protectorate has been advanced from 10 to 15 per cent. as from October 28th.

The New Railway Rates.

Mr. J. W. Parker, A.M.Inst.T., who wrote on "The New Railway Rates" and their effects on the electrical industry in the ELECTRICAL REVIEW for July 8th, 1927, is willing to render assistance to firms requiring guidance in connection with any part of the altered system which becomes effective on January 1st, 1928.

Social Event.

Messrs. Tamplin & Makovski, Ltd., electrical engineers, of Redhill, celebrated their thirtieth anniversary as a firm last week by entertaining over 50 employés to dinner. The health of the directors, proposed by Mr. Pike, was responded to by the managing director, Mr. A. W. Makovski, and the toast of the staff was submitted by Mr. J. Gibson, the other director of the firm, and was replied to by Mr. H. O. Collett. The health of the London manager, Mr. Yates, was also honoured.

Trade with Australia.

The principal of an Australian wholesale electrical and engineering company is at present in London. Manufacturers desirous of interviewing him should communicate in writing with Messrs. Sanderson, Murray & Elder, Ltd., 47, Gresham Street, E.C.2.

Indian Electrical Imports.

The value of the electrical equipment imported into India during August last was 39,00,000 rupees, as compared with 32,00,000 rupees in the corresponding month a year ago.

Book Notices.

We have received from the *Foundry Trade Journal* a reprint of an article upon tin appearing in its issue of November 10th. This deals in an interesting manner with the history of the metal, its occurrence, mining, smelting, properties, uses, reclamation and future.

"Armaments and the Non-combatant," by E. F. Spanner. Pp. xiv+319. Illustrated. London: Williams & Norgate, Ltd. Price 12s. 6d. net.

"Psychology as a Sales Factor," by A. J. Greenly. Pp. ix+214. London: Sir I. Pitman & Sons. Price 10s. 6d. net.

"Principles of Radio Communication," by J. H. Morecroft, A. Pinto, and W. A. Curry. Second Edition. Pp. xiv+1,001+64 figs. Price 37s. 6d. net.

"Collins' Engineers' Diary, 1928." London: Collins' Clear Type Press.—In addition to the diary proper, memoranda, notes, and so on, the new edition of this useful pocket book contains some 138 pages of engineering information and data arranged for quick and ready reference purposes. The contents are fully indexed.

"Annual Report of the Royal Technical College, Glasgow."—Contains the report on the 131st (1926-27) session adopted at the meeting of governors on October 18th, 1927.

For Sale.

The West Central Merchandise Mart will sell by auction, on November 23rd, at 10, Red Lion Passage, Red Lion Square, W.C., a quantity of v.i.r. and lead covered cables, wireless goods, &c. (See our advertisement pages to-day.)

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price November 15th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¼d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£107 to £112	...
b	,, Wire ... ... per lb.	1/6 to 2/-	...
b	,, Sheet ... ... ,,	1/3 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£235	£1 inc.
	Grade II ... ... ,, ,,	£163	£1 inc.
	Grade III ... ... ,, ,,	£85	...
c	Brass (rolled metal 2" to 12" basis) per lb.	9¾d.	...
c	,, Tubes (solid drawn) ... ... ,,	11¼d. to 11¾d.	...
c	,, Wire, basis ... ... ,,	9¼d.	...
c	Copper Tubes (solid drawn) ... ,,	1/0½	...
c	,, Bars (best selected) ... per ton.	£88	£2 inc.
c	,, Sheet ... ... ,,	£88	£2 inc.
c	,, Rod ... ... ,,	£88	£2 inc.
d	,, (Electrolytic) Bars ... ,,	£64	22s. 6d. inc.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£74	22s. 6d. inc.
d	,, ,, H.C. Wire per lb.	9/16d.	½d.
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	8/-	...
h	India rubber, Para fine ... ... ,,	1/3	½d. inc.
l	Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
l	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£22	5/- dec.
g	Mercury ... ... per bot.	£23	2/6 inc.
e	Mica (in original cases) small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up.	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/3	...
p	,, ,, rolled strip & sheet ,,	1/2½	...
p	,, ,, wire... ... ... ,,	1/3½	...
o	Platinum ... ... per oz.	£14 10s.	...
d	Silicium Bronze Wire ... ... per lb.	10½d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton.	£260 to £261	20/- to 30/- inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	4/2	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co. reported on November 12th that with large quantities of lead afloat for arrival this month and next month, and consumption continuing on the short side, there was nothing to stimulate prices and they looked for quiet markets for the time being.

Lighting and Power Notes.

Aldershot.—Electricity in Bulk.—The Town Council has received from the Electricity Commissioners amended terms by the War Office for the modification of the existing contract for the supply of electricity in bulk from the Aldershot Command power station. Terms have also been received from the Guildford Corporation for a bulk supply. The Electricity Committee is not prepared to submit any definite recommendation at present, and it has been suggested to the Commissioners that there should be further negotiations with the War Office for an amended and better offer.

Ashford (Kent).—Loan.—The Urban District Council has applied for sanction to a loan of £1,000 for the purchase of domestic electrical apparatus to be let out on hire.

Barnstaple.—Electricity Supply.—At the suggestion of the Electricity Commissioners, the Town Council is to engage a consulting engineer to prepare an independent report on the electricity undertaking generally.

Belper (Derbyshire).—Electricity Supply.—The Urban District Council has decided to ask the Derbyshire and Nottinghamshire Electric Power Co. to submit a scheme for the lighting of the town and to give an estimate of the cost.

Bere Alston.—Electricity Supply.—The village is to have an electricity supply through the initiative of Messrs. Glover and Uglow, of Callington, who have obtained powers to supply Bere Alston, Bere Ferrers, Calstock, St. Ann's Chapel, and Gunnislake, and other villages bordering on the Callington area. The promoters have formed the Bere Alston and District Light and Power Co., which is empowered to raise £7,000, but for the present only half of that amount is required. The equipment is standard to the requirements of the Electricity Commissioners. At a meeting of the local government electors on November 10th, two schemes, prepared by a committee of the Parish Council, were outlined, one for lighting Bere Alston only, and the other embracing Cotts, Weir Quay, and Bere Ferrers in addition. The latter scheme was adopted.

Brighton.—The National Scheme.—At a recent meeting of the Corporation, the Lighting Committee presented a report as to the effect upon the electricity undertaking of the proposed transformation of it into a centre for the supply of electricity to a large district. According to the *Brighton and Hove Herald*, the chairman of the Committee stated that the probability was that, by 1934, the Southwick station would become a generating station for a wide district, as already announced, but only for about five or six hours a day for five days a week. For the rest of the time Brighton would probably be drawing its supplies from one of the large generating stations near London. Thus the Brighton station would not be in continuous use, and therefore would not require the same staff as at present. Other work, or compensation, would have to be found for the displaced men.

Canada.—Electrical Development.—A merger which has been for some time in contemplation between the Abitibi Power and Paper Co., Ltd., and the Spanish River Pulp and Paper, Ltd., has been arranged by the directors and will include four other companies. The Fort William Power Co., Ltd., the Manitoba Paper Co., Ltd., the Ste. Anne Paper Co., Ltd., and the Murray Paper Co., Ltd. The plants included have a developed hydro-electric power in excess of 190,000 h.p., while power capable of being developed is estimated at approximately 500,000 h.p.

The Bathurst Company, Limited, pulp and paper manufacturers, are preparing to proceed with important developments in the valley of the Nipisiguit River in New Brunswick, which include the development of water power at Indian Falls on the Nipisiguit River. This development is understood to amount to 40,000 h.p.

With the switching-in of the new Quebec-Isle Maligne transmission line, a step towards higher transmission voltages has taken place in Canada. According to *The Electrical News*, until the advent of this project, the maximum voltage used in Canada was 110 kV, but the Shawinigan Water and Power Company, with 135 miles of 160 kV line, has exceeded that voltage. A further step forward will take place next year, when the Hydro-Electric Power Commission of Ontario will inaugurate its 200 miles of 220-kV line, now under construction from the Ottawa River to Toronto.

Continental.—Belgium.—The Société de l'Electricité de l'Ouest de la Belgique, which is now supplying electricity to 106 communes, extended its distribution system during the past financial year by about 178 miles, bringing the total length of the primary mains up to 283 miles, and the secondary system to 780 miles. The number of consumers increased during the year from 24,093 to 29,953, and the load from 16,774 to 20,303 kW.

Douglas (I. of M.).—Electricity in Bulk.—The Corporation Electricity Committee is in communication with the Manx Electric Railway for terms for a temporary bulk supply of electricity.

NEW PLANT.—The Committee has under consideration a report by Mr. J. A. Robertson, electrical engineer, on the proposed plant extensions, recommending the installation of two 1,000-kW steam turbine sets with the necessary boilers at Pulrose, and changing the distributing system to a.c.

Easingwold (Yorks.).—ELECTRICITY SUPPLY PROGRESS.—As a result of the increasing demand for electricity, Messrs. John C. Bannister & Co., Ltd., have had to considerably increase the plant at their power station, and have changed over the supply voltage from 110 to 230. The area of supply has been increased, and all portions of the town are now lit with electricity.

Edwinstowe (Notts.).—ELECTRICITY SUPPLY.—The *Financial News* states that the Bolsover Colliery Co., Ltd., has arranged to supply electricity to the village. The scheme serves the old village of Edwinstowe as well as the new village belonging to the colliery company for housing the families of the men who will be employed at the company's new Thoresby Colliery. Electricity will be supplied from the company's own power main, a 22,000-V cable, 30 miles in length, which connects all the collieries (Bolsover, Creswell, Mansfield, Clipstone, Rufford and Thoresby) under the company's control.

Ilford.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. A. H. Shaw) on the working of the electricity undertaking for the year ended March 31st last, shows a total income of £123,451, as compared with £103,316 in the preceding year. Working expenses amounted to £94,679, as against £74,424, leaving a gross profit of £28,773 (£28,892). After payment of capital charges there was a net surplus of £2,855, as compared with £359 in 1925-26. The capital expenditure during the year amounted to £58,833, the chief item being £33,777 for mains and services. The electrical energy generated by the Council amounted to 6,866,700 kWh and 8,344,618 kWh was purchased in bulk from West Ham Corporation. The sales of electricity increased from 10,399,083 to 12,031,221 kWh, and the maximum supply demanded from 5,805 to 6,742 kW. Domestic apparatus on hire at the end of the year totalled 5,790, the number of hire agreements entered into during the year being 2,538.

India.—ELECTRICAL PROGRESS.—The twenty-fifth anniversary of the power station of the Mysore State was recently celebrated, when the progress during the period was reviewed. The station, which was inaugurated in 1902 with a capacity of 4,000 h.p., now has plant with ten times that capacity. Nearly three-fourths of this is utilised by the gold mining companies of Kolar and the rest is used for minor industrial and lighting purposes in the cities of Mysore and Bangalore. With a capital investment at nearly two crores of rupees, the scheme has paid for itself and annually yields a net revenue to the State of over Rs. 20 lakhs. Sir M. Vishwshwarayya has estimated that the scheme is capable of being developed to 100,000 h.p. in the near future.

The Calcutta Electric Supply Corporation has applied to the Government of Bengal for a licence to install an electric lighting plant at Serampore, a few miles from Howrah.

The Government of Bombay has granted a licence to Messrs. P. Patel & Co., of Bombay, for the supply of electrical energy to the town of Thana.

A project is on foot for the supply of electric power and light to the town of Belgaum, in the Bombay Presidency.

Irish Free State.—LIMERICK.—Dr. McLoughlin, a member of the Shannon Electricity Board, recently attended a special meeting of the Corporation Electricity Committee in connection with the question of a supplementary supply of electricity to the city, which is required during the coming winter. Dr. MacLoughlin said the Board had gone into the matter with the contractors, who stated they would not be able to deliver a supply until the winter of 1929. The doctor, therefore, suggested that consumers should be asked to conserve consumption in order to cope with the winter's load. The Board could not agree to accept a d.c. system. The Committee decided to recommend the installation of new batteries at an approximate cost of £4,000.

Lincoln.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £7,078 for electricity purposes.

London.—SOUTHWARK.—In a recent address, the Mayor of Southwark, referring to the electricity undertaking, stated that although the electricity sold for the past year showed a slight decrease from the previous year's figure, due to the strike, the maximum demand on the station increased by 274 kW. The generating cost during the year was affected by the dislocation of trade arising out of the general strike, but since then rapid progress had been made towards recovery, and the current year should show a return to normal expenditure. The year's working resulted in a net profit of £4,121, out of which £1,377 was paid over to the general fund in relief of rates. Negotiations are now in progress which will enable the Council to extend its undertaking.

Manchester.—PROGRESS DURING SEPTEMBER.—During the month of September the Corporation electricity undertaking showed an increase in connections of 1,441 kW, bringing the total up to 328,752 kW; and the number of applications received for supply, including consumers for additional supplies, was 1,365, representing a total of 2,963 kW. The number of hired cookers connected increased by 97, bringing the total actually on circuit to 3,677. Applications for the hire of cookers totalled 135. Three new sub-stations were put into commission during the month, and an additional 500-kVA transformer was installed in an existing sub-station on the premises of Messrs. C. Macintosh & Co., Ltd.

Paisley.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. W. Blair Smith) for the year ended May 15th last, record a total income of £104,184, as compared with £78,046 in the preceding year. Working expenses amounted to £68,688, as against £55,485, leaving a gross profit of £35,496 (£22,561). After meeting capital charges there was a net deficit of £5,923, as compared with £11,097 in the previous year. The capital expenditure during the year amounted to £47,730, the chief item being £32,723 for mains. The electrical energy generated by the Corporation was 5,293,260 kWh, and the amount purchased from the Clyde Valley Electric Power Co. 7,201,555 kWh. The sales of electricity increased from 9,210,538 to 10,481,658 kWh, and the maximum supply demanded from 4,900 to 5,470 kW.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

FORMBY.—Lighting: First 500 kWh per annum, 7d. per kWh; all electricity in excess of this amount, 6d. per kWh. Power: First 500 kWh, 2½d. per kWh; over 500 kWh, 1½d.

SUNDERLAND.—Domestic rate: The "unit" charge from ½d. to ¼d. Heating and cooking: Instead of 1½d. per kWh for the first 1,000 kWh per quarter and 1d. beyond, the charge for cooking and intermittent heating will be ½d. per kWh, and for radiators and fires, where they are the sole source of heat, ¼d. per kWh.

Reigate.—LOANS.—The Town Council has applied for sanction to loans of £3,000 for mains, and £2,000 for services.

ELECTRICITY IN SMALL HOUSES.—The Council has decided that 26 houses to be built on the Smoke Lane site shall be lighted by electricity, and wired under the hire-purchase system.

Seaton (Devon).—PLANT EXTENSIONS.—Mr. P. O. Witley, resident engineer, informs us that the Seaton and District Electric Light Co., Ltd., is to double the present capacity of its oil engine power station in order to meet the increasing demands for an electricity supply.

Sheffield.—MAINS EXTENSIONS.—During the past month the Corporation Electric Supply Committee has approved extensions of mains at an outlay of £10,909.

NEW SUB-STATION.—The Committee has received sanction to the borrowing of £5,700 for a sub-station and equipment for the Wadsley area.

Spalding.—EXTENSION OF SUPPLY.—The Urban District Council has decided, provided that 150 consumers along the route are guaranteed, to erect an overhead cable to supply electricity to the parishes of Pinchbeck, Surfleet, Gosberton, Quadring, and Donington, at an approximate cost of £12,000.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Great Yarmouth Corporation to supply electricity in the rural district of East and West Flegg, and parts of the rural districts of Blofield, Loddon and Clavering, Smallburgh, Mutford and Lothingland, and Wangford; the West Gloucestershire Power Co., Ltd., to supply in parts of the rural districts of Tetbury, Cirencester, Chipping Sodbury, and Thornbury; Edmundson's Electricity Corporation, Ltd., to supply in parts of the rural districts of Reigate and Dorking; and the County of London Electric Supply Co., Ltd., to supply in the urban district of Epping and part of the rural district of Epping.

Sunderland.—LOANS SANCTIONED.—The Town Council has received sanction to loans totalling £24,997 for electricity purposes.

Torquay.—ELECTRICITY SUPPLY.—The Town Council has received sanction to loans of £28,620 for plant, &c., for extensions to the power station at Newton Abbot. A Special Order to include parishes in the rural districts of Newton Abbot and Totnes, and in the urban districts of Ashburton and Buckfastleigh in the area of supply has been applied for. The estimated cost of the extension during the first two years is £7,150.

Tramway and Railway Notes.

China.—HARBIN.—A portion of the tramway of Harbin, nearly two miles in length, was opened to traffic on October 10th. Construction of the tramway was started six years ago by a company organised by Kirin merchants, and was later taken over by the Kirin provincial government. Building of the tramway and power station and the purchase of cars has cost seven million dollars.

Continental.—ITALY.—The new Coni-Nice and Coni-Ventimiglia railways will be inaugurated on May 15th. They will be electrified only as far as the French frontier. On the opening of the Ventimiglia-Coni-Turin line several of the present Ventimiglia-Savona-Turin trains will be withdrawn. The Savona-Ventimiglia line will be electrified in 1929. Next

year work will commence at Ventimiglia on a large depôt to house the locomotives used on the lines to Coni and Savona.—*Reuter's Trade Service* (Rome).

Switzerland.—By the end of the present year there will be about 930 miles of electrified railway in operation on the Swiss Federal Railway system. During next year work on the electrification of the Sargans-Rorschach, Zollikofen-Biel, and Munster-Delsberg sections is expected to be completed, so that by the end of 1928 the electrified lines will have a length of nearly 1,040 miles, more than half the total Federal system.

India.—Railway Electrification.—Good progress is reported with regard to the scheme for the electrification of suburban railways serving Calcutta. It has now been decided to electrify the Naihati-Sealdah, Sealdah-Magrahat, Ballygunge-Budgebudge, Sealdah-Kachrapara, Bandel-Bally, Bally-Dumdum junction, Bandal-Naihati and Balli-Howrah sections. The extension of the lines from Sealdah to Howrah *via* Lyon's Range, Dalhousie Square, with several intermediate stations in the city itself is also under consideration. A special officer of the Railway Board has been deputed to study the situation in these areas, and especially to ascertain whether there will be a movement of the population to the suburbs if the railway system is electrified.

Lincoln.—Loan.—The City Council has applied to the Ministry of Transport for sanction to a loan of £25,000 for the purchase of 15 omnibuses for service when the tramway system is discontinued.

Manchester.—Tramway Improvements.—The Corporation Tramways Committee is to extend the loop line in Pottery Lane, Openshaw, and double the tramway track in Withington Road, Brooks Bar.

Rotherham.—Supply for Railless Cars.—In order to improve the running of the railless cars on the Maltby route the Corporation Tramway Committee proposes an expenditure of £7,000 upon new cables, sub-station, and plant. The capacity of the sub-station will be 300 kW, but it will be so arranged that it can be easily extended when required.

Road Maintenance.—At a recent meeting of the Corporation Tramways Committee it was decided to ask the Parliamentary Committee to promote a Bill to relieve the Tramways Department of the cost of maintaining the surface of the roads, and to provide that in the event of the abandonment of tramways the responsibility of the Department shall be limited to the actual cost of removing the rails.

Salford.—Year's Working.—The report of the general manager (Mr. J. S. D. Moffett) on the working of the Corporation tramway undertaking for the year ended March 31st last records a total income of £517,472, as compared with £526,802 in the preceding year. Working expenses amounted to £454,561, as against £439,531, leaving a gross profit of £62,901 (£87,271), to which was added revenue from other sources making a total of £75,272 available. After payment of capital charges there was a net deficit of £13,222, as compared with £1,757 in 1925-26. All the above amounts embody the figures for the motor-omnibus services. The number of passengers carried decreased from 83,881,591 to 81,839,560, and the car miles run from 6,377,694 to 6,282,208. The receipts per car-mile fell from 17.966d. to 17.874d.

York.—Scheme Rejected.—The City Council has rejected a recommendation by the Tramways Committee that application be made for power to run railless-car services on the existing tramway routes, and to introduce motor-'bus services to places within a 10-mile radius of the city boundary.

Telegraph and Telephone Notes.

Cocos Islands.—Radio Station Reopened.—The British Chamber of Shipping has been notified that the radio-telegraph station on the island, which was closed on November 30th, 1926, has been reopened for the receipt and dispatch of private messages and distress calls.

Czecho-Slovakia.—Long-distance Telephony.—On November 14th underground telephone communication between Paris and Prague was inaugurated by Dr. Peroutka, Czecho-Slovakian Minister of Commerce, and M. Bokanowski, French Minister of Commerce. Dr. Peroutka telephoned that the inauguration of the first long-distance service between Prague and the German system in the direction of Dresden would ensure sure connection with France.

Holland.—Radio-Telephony.—The Postmaster-General of Holland has issued a *communiqué* in which he says that he has obtained excellent results with short-wave radio-telephony between Holland and the Dutch East Indies, and that, if results can be maintained, regular telephone communication between the Netherlands and its Colonies will be assured.

Tariff.—The telephone tariff between Holland and England will be decreased by 20 per cent. as from December 1st. The tariff between Holland and Belgium and Holland and France will also be decreased.

Poland.—Telegraph Service.—As a result of the development of communication by telephone, the use of the telegraph service is declining in Poland as in other countries. The Ministry of Posts and Telegraphs is consequently laying this year only an insignificant number of new telegraph lines; they will reinforce the present systems between Warsaw and Gdynia, Warsaw and Posnan (Posen), and Posnan and Cracow, *via* Katowice.—*Reuter* (Warsaw).

Sweden.—Telephone Service.—The British Postmaster-General announces the extension of the Anglo-Swedish telephone service to a number of places in the neighbourhood of Stockholm and Gothenburg and also to Malmö and Helsingborg. The zones are the same as in the other Anglo-Continental services.

The Telephone Service.—London's Automatic Exchange.—The Post Office Telephone Department placed the Holborn automatic exchange in service at midnight on November 12th. Some 4,800 subscribers are concerned, this being the first public automatic exchange in London.

Brighton Exchange.—At midnight on November 12th the new automatic system in the Brighton area was inaugurated.

Rural Telephones.—The General Post Office has arranged for the installation of telephones for the use of the public at small rural railway stations throughout the country. The difficulty has been to provide a remunerative service at places where the volume of traffic was not calculated to meet the expense of erecting and maintaining a cabinet equipped with a telephone and a coin box with which the public are familiar in large towns. The difficulty has now been overcome with the co-operation of the railway companies. The Post Office will install a telephone in a convenient place in the station, says *The Times*, and a railway official will have charge and receive the money paid for the call.

Radio Notes.

Australia.—Radio Dealers.—At the end of June, 1927, some 2,797 persons were licensed as radio dealers, of whom 916 were in New South Wales, 1,024 in Victoria, 344 in Queensland, 335 in South Australia, 49 in Western Australia, and 129 in Tasmania, says the Royal Commission in its report, and evidence before it suggests that a number have no knowledge of the technical side of radio, and in at least some instances have sold sets of inferior quality. Under the present regulations, each dealer's representative who demonstrates a set for sale is bound to have a licence, for which the annual sum of £5 must be paid. The Commission is of opinion that when the employer himself holds a dealer's listening licence, he should be entitled to obtain further licences for his employés at reduced fees.

Empire Broadcasting.—Chelmsford Station.—The B.B.C., which celebrated its fifth birthday on November 15th, inaugurated its short-wave station (5 SW) at Chelmsford on November 11th. The aerial power will be between 15 and 20 kW, with a wavelength of 24 metres, and elaborate precautions have been taken to maintain constancy of frequency. The aerial is of the same type as the Marconi "beam" pattern, but has no screen wires behind it and so is non-directive. The oscillatory system is the standard Marconi one, but the modulator has been built up experimentally. It is explained in *World-Radio* that the plant has been primarily installed to facilitate "two-way" experiments between England and America in conjunction with new reception methods and the Radio Corporation of America.

The 5 SW programme was re-broadcast all over the U.S.A. and Eastern Canada, but in New Zealand and Australia attempts to relay it were not so successful owing to fading.

The Radio Conference.—Voting Power Question.—The committee on "Charges for Wireless Dispatches," one of the chief committees of the Washington Radio Conference, has finished its work and adjourned *sine die*. The United States delegates, however, are not expected to subscribe to its findings, as Americans oppose the international regulation of private concerns. Satisfactory progress was reported in the discussion on the allocation of short-waves to various services. An understanding is also reported to have been reached on the allocation of votes to various nations. It is understood that the United States, France, Italy, Japan, and Germany will have six votes each and Great Britain eight. This understanding is expected to arouse opposition from some of the lesser countries, particularly those in South America, which will be allowed only one vote each, despite the fact that they sought larger influence in voting, on the ground of the size of their territories. Mr. Hoover expressed the hope that an agreement would be reached by the Conference on all points by November 12th.—*Reuter* (Washington).

The American delegation to the Conference set a precedent on November 11th by agreeing at a plenary meeting of the Convention Committee to the inclusion of an unconditional and compulsory arbitration clause in an international treaty binding upon the United States. The delegation voted for compulsory arbitration for the settlement of any international dispute arising from the Convention.—*Reuter* (Washington).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—BUENOS AIRES.—January 17th. National Sanitation Works Department. Three 350-kW Pelton-type turbines and 6,600-V, three-phase generators. Two 20-kVA 3-phase static transformers, one distribution switchboard and connections, &c. (B.X. 3921.)*

Australia.—SYDNEY.—December 7th. N.S.W. Government Railways. One 5-ton and one 25-ton electric travelling cranes. (A.X. 5447.)*

MELBOURNE.—January 3rd. Postmaster-General's Department. Switchboard lamps, lamp caps, and lamp sockets. (B.X. 3943.)*

December 13th. Submarine cable. (B.X. 3963.)*

January 11th. Electricity Department. Replating battery of accumulators. Specifications from the City Electrical Engineer.

January 23rd. State Electricity Commission of Victoria. 6,600-V automatic induction voltage regulators. (B.X. 3972.)*

Ayr.—November 29th. Tramways Committee. Stores for 12 months, commencing January 1st, 1928, including overhead line material, &c. Forms of tender from the Manager.

Blackpool.—December 15th. Electricity Committee. One 1,750-kW motor-convertor for traction supply. (November 11th.)

Bootle.—November 22nd. Electric lighting installation for the Maghull Sanatorium. Specifications, &c., from Borough Engineer, Town Hall.

Dewsbury.—December 12th. Corporation. Pumps, motors, and other electrical plant for the Ravensthorpe sewage works. Specification (£2 2s.) from the borough engineer, Mr. H. Dearden.

Donegal.—November 21st. Board of Health. Electric wiring installation for the Letterkenny District and Fever Hospital; overhead line from the Mental Hospital to the Fever Hospital. Specifications from Dr. Doherty, 12, Castle Street, Derry.—*Irish Builder and Engineer.*

Egypt.—CAIRO.—November 26th. Ministry of the Interior. One 128-kW Diesel engine-driven electrical installation for the town of Simbellawem. (B.X. 3885.)*

Harrogate.—November 28th. Electricity Department Twelve months' supply of cable. (See this issue.)

Hastings.—December 5th. Electricity Department. One turbo-alternator and one water-tube boiler. (November 4th.)

Hawarden.—November 23rd. Electricity Department. Transformers for sub-station. (November 11th.)

Hull.—December 7th. Electricity Committee. Boiler house steel structure, h.p. water-tube boilers, coal- and ash-handling plant. (November 4th.)

India.—November 25th. Bombay, Baroda and Central India Railway Co. Electric jib cranes, &c. Specification (20s.) from Mr. S. G. S. Young, secretary, White Mansion, 91, Petty France, Westminster, S.W.1.

London.—November 22nd. North British Aluminium Co., Ltd. Water turbines, alternators and exciters for the Lochaber water power scheme. (October 28th.)

SOUTHWARK.—November 24th. Board of Guardians. Complete wireless installation for the Southwark Hospital, East Dulwich Grove. (October 28th.)

CENTRAL ELECTRICITY BOARD.—December 22nd. 132,000-V transformers for the Central Scotland Electricity Scheme, 1927. (November 11th.)

STEPNEY.—November 30th. Board of Guardians. Installation of an electric lift at the St. George's-in-the-East Hospital. (See this issue.)

BERMONDSEY.—November 29th. Borough Council. Microphone and loud-speaker apparatus for the public hall at the Central Baths. (See this issue.)

Lourenco Marques.—February 13th. Ports and Railways. Two 350-h.p. electric motors. (B.X. 3996.)*

Manchester.—November 28th. Electricity Committee. H.p. steam and feed-water pipework. (November 4th.)

November 21st. Safety cartridge fuse fittings for 12 months. (November 11th.)

December 13th. Tramways Committee. Magnetic track brakes for tramcars. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

December 5th. Steel valves and traps for h.p. steam and water. (See this issue.)

New Zealand.—WELLINGTON.—December 13th. Public Works Department. Three 10-ton overhead travelling double-girder cranes. (A.X. 5378.)*

December 13th. 50-V lightning arrestors for the Arapuni power scheme. (B.X. 3919.)*

January 10th, 1928. Additional 110,000-V switchgear, steelwork and control board for Arapuni electric power supply. (B.X. 3837.)*

January 17th. 110,000-V switchgear, protective apparatus, steelwork, storage batteries, &c., for the Waikaremoana power scheme. (B.X. 3858.)* 50-kV switchgear and steelwork for Arapuni. (B.X. 3917.)* 11,000-V switchgear and metering equipment for Arapuni (Sec. 254). (B.X. 3920.)*

January 24th. 11,000-V switchgear and metering equipment for Arapuni (Sec. 261). (B.X. 3918.)*

CHRISTCHURCH.—March 13th. Drainage Board. Nine electric centrifugal sewage pumping plants. (A.X. 5457.)*

Oldham.—December 3rd. Electricity Committee. Railway sidings at new power station. (See this issue.)

Porthcawl (Glam.).—December 5th. Electricity undertaking. Switchgear, transformers, overhead and underground mains. (November 11th.)

Pontefract.—November 26th. Installation of electric lighting at public baths and destructor. Specifications from Mr. W. H. Newton, borough engineer, Municipal Offices, Pontefract.

Preston. — December 14th. Electricity Committee. 32,000 tons of fuel for Ribble power-station, Penwortham, required during the year ending December 31st, 1928. Specification from Mr. J. F. Simpson, borough electrical engineer, 118, Fishergate.

South Africa.—TULBAGH.—December 12th. Municipal Council. Erection of power station and distribution network. (B.X. 3911.)*

JOHANNESBURG.—December 10th. Municipal Council. Induction voltage regulators. (B.X. 3973.)*

January 3rd. Municipal Council. 32 transformers. (B.X. 3991.)*

December 29th. S.A. Railways and Harbours. One 5-ton 3-motor electric overhead travelling crane for East London workshops. (A.X. 5506.)*

Southend-on-Sea.—November 24th. Light Railways and Electricity Department. 1,300 d.c. house-service meters. (See this issue.)

Uruguay.—MONTEVIDEO.—December 19th. State Electricity Works. Six Diesel oil-engine generating sets. (B.X. 3966.)

February 5th. Ministry of Public Works. 22 cranes for the Hydrographic Department. (A.X. 5478.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—SYDNEY.—Electricity Supply Committee. Recommended :—

Rubber-insulated cable (Spec. 1155) (£4,580).—Australian General Electric Co., Ltd.

Overhead service fittings (Spec. 1160).—Balmain Motor and Engineering Works (£656); British General Electric Co., Ltd. (£715).

D.c. consumers' meters (£1,950).—Noyes Bros. (Sydney), Ltd.

Steel chimneys for Bunnerong power station (Spec. 1173) (£19,804).—Clyde Engineering Co., Ltd.

Bare copper cable (Spec. 1164) (£19,717).—W. Adams and Co., Ltd.

H.p. and l.p. cables and cable end boxes (Spec. 1137), Sec. A, D and E (£17,649).—Enfield Cable Works, Ltd. Sec. B and C (£1,928).—Metropolitan-Vickers Electrical Co., Ltd. Sec. F (£1,745).—Australian General Electric Co., Ltd. —*Tenders.*

Bolton.—

Electric lighting installations at the Bolton Greyhound Racing Track and also at the Victoria Mill, Moses Gate, near Bolton.—T. Francis & Sons.

Durham.—County Council. Recommended:—
Electric lighting installation at the County Library headquarters, Old Elvet.—Kelly & Co.
Renewal of battery plates at sanatorium (£141).—Tudor Accumulator Co., Ltd.

Glasgow.—Finance Committee. Recommended:—
Main switchboard and wiring at Pollokshaws Burgh Hall.—Allan Arthur & Ure.
Switchboard at Whiteinch Burgh Hall.—Chas. Maguire.

Watch Committee. Recommended:—
Electrical installation at Bridgeton halls (£1,376).—T. B. and J. A. Matheson, Ltd.
Electrification of passenger lift at central police chambers (£279).—Glasgow Engineers, Ltd.
Switchboards at Kinning Park Hall and Springburn (£47).—Charles Maguire.

Tramways Committee. Recommended:—
D.C.C. wire.—General Electric Co., Ltd., and W. T. Henley's Telegraph Works Co., Ltd.
Special track work.—Thermit, Ltd., Hadfields, Ltd., and Edgar Allen & Co., Ltd.

Greenwich.—Board of Guardians. Accepted:—
Installation of a new switchboard and cable at the Greenwich and Deptford Hospital (£401).—Johnson and Phillips, Ltd.

Hawarden.—Board of Guardians. Accepted:—
Wiring Laburnum House for electricity (£115).—G. G. Threlfall (Queen's Ferry).

Highfield.—Durham County Education Committee. Accepted:—
Electric lighting. Highfield School.—Simm & Richardson.

Hull.—Tramways Committee. Accepted:—
Cable renewal at Hedon Road (£1,520).—Siemens Bros. and Co., Ltd.

Irish Free State.—DUBLIN.—Public Works Department. Accepted:—
Electric lighting installation at Limerick Military Barracks.—D. Thompson & Sons, Ltd.
Laying electric cable in Phœnix Park, Dublin.—Dublin Corporation Electricity Department.
—*Irish Builder and Engineer.*

Lamp Contract.—The Great Western Railway Co. has renewed the contract for the supply of vacuum electric house-lighting and train-lighting lamps with Omega Lampworks, Ltd.

Leeds.—Sewerage Committee. Accepted:—
Supplying and laying electric power and lighting cables to Thorpe Stapleton pumping station (£1,307).—Clokes Extension, Ltd.

Electricity Committee. Accepted:—
Cables.—Macintosh Cable Co., Ltd. (£801); Enfield Cable Works, Ltd. (£705).

London.—METROPOLITAN WATER BOARD.—Recommended:—
Two 150-kW steam-driven electric generators, switchboard and piping, for Hampton pumping station:—

Newton's Dynamo Works	£3,350
Ashworth & Parker. (Recommended.) ...	**3,613**
W. H. Allen, Sons & Co., Ltd.	3,650
Browett, Lindley & Co., Ltd.	3,684
Electric Construction Co., Ltd....	3,704
G. N. Haden & Sons, Ltd.	3,751
Peter Brotherhood, Ltd.	3,802
Brush Electrical Engineering Co., Ltd. ...	3,817
James Howden & Co., Ltd.	3,955
General Electric Co., Ltd.	4,086
Rees Roturbo Manufacturing Co., Ltd. ...	4,172
City Electrical Co., Ltd.	4,235
Brightside Foundry and Engineering Co., Ltd.	4,900

FULHAM.—Borough Council. Accepted:—
Electricity showrooms (£11,547).—W. J. Marston & Sons.

Marlborough.—Town Council. Accepted:—
Underground and overhead cable (£539).—John Collier.

Plymouth.—Tramways Committee. Accepted:—
Car-washing plant (£140); 25 steel standards (£240).—Equipment & Engineering Co., Ltd.
Two motors for tramcars (£416).—English Electric Co., Ltd.

Sheffield.—Health Committee. Accepted:—
Maintenance of hospital internal telephone and bell systems for 12 months (£55).—T. A. Ashton, Ltd.

Stafford.—County Education Committee. Accepted:—
Installing electric light and power in the new wing at Stafford Grammar School (£754).—W. G. France, Darlaston.

Wolverhampton.—
Electrical power installation at the new Goodyear tire factory.—B. French (Kidderminster).

Yarmouth.—Town Council. Accepted:—
One 7,500-kW turbo-alternator (£24,921).—Brush Electrical Engineering Co., Ltd.

Forthcoming Events.

British Electrical Development Association. — Friday, November 18th. Royal Society of Arts, London, W.C. 7.30 p.m. "Assisted Wiring, Hire and Hire Purchase Schemes: Recent Progress." Mr. S. E. Fedden.

Junior Institution of Engineers.—Friday, November 18th. Caxton Hall, Westminster, S.W. 7.30 p.m. Presentation of medals and awards by the retiring President, Engineer Vice-Admiral Sir R. B. Dixon. Inaugural address by the president, Sir M. MacDonald.
Friday, November 25th. 39, Victoria Street, S.W. 7.30 p.m. "A Talk about Pioneers in High Pressure Steam." Mr. L. P. Perkins.

Chemical Engineering Group.—Friday, November 18th. Burlington House, W. 8 p.m. "Some Modern Methods of Recovery of Lubricating Oils." Mr. A. J. Broughall.

Midland Electrical Engineers' Ball.—Friday, November 18th. Grand Hotel, Birmingham.

Röntgen Society and British Institute of Radiology.—Friday, November 18th. Central Hall, Westminster, S.W. 10.30-7 p.m. Inaugural meeting and exhibition of apparatus. 7.30 p.m. Grand Central Hotel. Dinner.

Electrical Power Engineers' Association (Kent Section).—Saturday, November 19th. Old Palace, Maidstone. 5.30 for 6 p.m. Annual dinner.
(Southern Division).—Wednesday, November 23rd. Institution of Electrical Engineers, London, W.C. 7 p.m. "Some of the Technical Problems of Broadcasting." Capt. P. P. Eckersley.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, November 21st. Institution, London, W.C. 7 p.m. "Automatic Telephony." Mr. W. Day.
(Mersey and North Wales (Liverpool) Centre.—Monday, November 21st. University, Liverpool. 7 p.m. "Radio Sets on the Mains." Mr. W. J. Wyborn.
(South-Midland Centre).—Friday, November 25th. Grand Hotel, Birmingham. Annual dinner.
(North-Western Students' Section). — Tuesday, November 22nd. Milton Hall, Manchester. 7 p.m. "The Electricity (Supply) Act, 1926." Mr. J. A. Robertson.
(Scottish Students' Section).—Wednesday, November 23rd. Royal Technical College, Glasgow. 7.30 p.m. "The Electro-Turbine Pump." Mr. H. W. Ritchie.
(London Students' Section).—Friday, November 25th. Institution, London, W.C. 6.15 p.m. "Sources of Illumination." Mr. G. H. Wilson.

Illumination Design Course.—Monday, November 21st. Lighting Service Bureau, Savoy Street, W.C. 7.30 p.m. "The Art of Home Lighting."

British Science Guild.—Monday, November 21st. Goldsmiths' Hall, E.C. 4 p.m. Norman Lockyer lecture. "Scientific Ethics." Very Rev. Dean Inge.

Royal Society of Arts.—Monday, November 21st. John Street, Adelphi, W.C. 8 p.m. Cantor lecture. "Alloy Steels, their Manufacture, Properties and Uses." Prof. H. C. Carpenter, F.R.S. (Lecture II.).

Illuminating Engineering Society.—Tuesday, November 22nd. Lighting Service Bureau, 15, Savoy Street, W.C. 7 p.m. Opening meeting. Report of progress during the vacation, and on progress in electric lamps and lighting appliances.

Royal Institution of Great Britain.—Tuesday, November 22nd. Albemarle Street, W. 5.15 p.m. "A Year's Work in X-ray Crystal Analysis." Sir William Bragg, F.R.S.

Empire Mining and Metallurgical Congress.—Tuesday, November 22nd. Hotel Victoria, Northumberland Avenue, W. 7.15 for 7.45 p.m. Dinner.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, November 22nd. Rankine Hall, Glasgow. 7.30 p.m. Ordinary meeting.

Institute of Fuel.—November 23rd and 24th. Institution of Electrical Engineers, London, W.C. Presidential address by Sir A. Mond.

South Wales Institute of Engineers' Exhibition.—Drill Hall, Cardiff. November 23rd to December 3rd.

Electrical Association for Women.—Thursday, November 24th. 3 p.m. Visit to Electrolux, Ltd., 153-155, Regent Street, W. Lecture on "The Value of a Refrigerator in Winter."

Institute of Wireless Technology.—Thursday, November 24th. Engineers' Club, W. 7 p.m. "Ultra Short Waves." Mr. W. H. B. de M. Leathes.

Institution of Engineering Inspection.—Friday, November 25th. Royal Society of Arts, London, W.C. 7.30 p.m. "Elutriation as an aid to Engineering Inspection." Mr. L. Andrews.

Physical Society.—Friday, November 25th. Imperial College of Science, S. Kensington, S.W. 5 p.m. Ordinary scientific meeting.

Diesel Engine Users' Association.—Friday, November 25th. "Centrifugal Castings for Diesel Engines." Mr. J. E. Hurst.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

BLITZ water heaters.
GOLD SEAL home chargers.
Gastight 4-way junction boxes.

We are also asked for the address of any British agent representing the Home Appliance Mfg. Co., Camden, New Jersey; and the names of firms prepared to undertake vitreous enamelling.

Notes.

The "Product Integraph."

An electrical "thinking machine" has been perfected at the Massachusetts Institute of Technology by Dr. Vannevar Bush, professor of electric transmission, and a staff of research workers, says the *T. and T. Age*. Work on it began several years ago, with the object of meeting the need for a machine which would automatically solve problems of advanced electrical theory rapidly and accurately. The integraph is a watt-hour meter: the mathematician plots the equations he is interested in on sheets of paper which are passed under pointers, and operators along the machine keep the pointers on the curves. As the pointers move, the power flowing through the meter varies in proportion and controls a motor which drives a pencil on another sheet of paper, tracing a curve (the integral) which is the result sought. A second device, somewhat different from the first, but performing the same operation, integrates the result a second time. The apparatus will solve practically any "second order differential equation," a type which in many cases can be solved only after months of computation

The Efficacy of Rubber Gloves.

In a letter to the *Manchester Guardian Commercial*, Mr. J. Haworth, the secretary of the India Rubber Manufacturers' Association, protests against a statement made at the inquest on Mr. W. E. Miller, who was killed by an electric shock at the Daventry broadcasting station. This was to the effect that Mr. Miller was not wearing rubber gloves at the time of his death, and in any event rubber gloves would not have stood a pressure of 9,000 V. Mr. Haworth says that gloves made by members of his Association can be guaranteed to withstand up to 30,000 V, and "the current practice is to test such gloves up to a limit of 10,000 V."

International Commission on Illumination.

A very successful meeting of the technical committees of the International Commission on Illumination was held at Bellagio in September last; about 70 delegates were present, including representatives of the ex-enemy nations. The meeting was preparatory to the plenary session of the Commission which is to be held in the United States next year. The British representatives were Mr. C. C. Paterson (director, G.E.C. Research Laboratory), now president of the Commission; Lt.-Col. K. Edgcumbe, vice-president; Dr. J. W. T. Walsh (N.P.L.), general secretary of the Commission; Mr. J. Macintyre (H.M. Office of Works); Mr. L. Gaster (hon. secretary, Illuminating Engineering Society); Mr. P. Good (I.E.E.); Dr. E. H. Rayner and Mr. H. Buckley (N.P.L.); Mr. W. Bush (E.L.M.A. Lighting Service Bureau); Mr. L. B. W. Jolley (G.E. Co.); Mr. R. Watson (Inst. of Gas Engineers); and Mr. E. Willis (Inst. of Municipal and County Engineers). Forty-six papers and commentaries were submitted by National Committees, and were considered by the delegate conferences or the appropriate technical committees, the latter dealing respectively with the vocabulary, definitions and symbols, factory and school lighting, automobile headlights, and heterochromatic photometry. Industrial lighting from the point of view of glare received considerable attention, and the British Specification for an Industrial Reflector Fitting, in which very successful efforts were made to eliminate glare, received favourable comment. Motor-car headlights were also discussed at some length; it appears that there is growing a consensus of opinion that "dimming" is very undesirable, and that two light distributions should be available for each headlight.

In addition to the meetings of the technical committees, two delegate conferences were held, and very important additions to the programme of work of the Commission were made. The Commission is now committed to an intensive study of such new subjects as signal glasses, daylight illumination, street lighting, fundamental research on glare, &c. The secretarial work involved has been allotted to the various national committees, which each take responsibility for one or two subjects. Great Britain is acting as the "secretariat" for the subjects of Signal Glasses and Daylight Illumination. The results of the work of the next twelve months will be reported in America in September, 1928.

Mr. C. C. Paterson was elected president of the Commission in succession to Dr. E. P. Hyde (U.S.A.).

We have received a booklet from the British National Committee, summarising the work accomplished at the meeting, which can be obtained from the general secretary of the Commission at the National Physical Laboratory, Teddington, price 2s.; it is an unofficial account of the proceedings, anticipating the complete report, which will be published in French at a later date. Besides particulars of the constitution and organisation of the Commission, the booklet contains a cursory report of the proceedings at the Bellagio meeting, a list of the papers submitted, a list of the delegates present, and a photograph of the latter. In view of the delay entailed in the preparation of the official report, the British Committee is to be congratulated on the issue of this preliminary account of the meeting.

The Electrical Trades Benevolent Institution.

The annual festival of this Institution will be held on Wednesday, February 8th, 1928, at the Trocadero Restaurant, London, at 7.30 p.m., when Mr. J. W. Beauchamp, M.I.E.E., will preside.

Portrait of Professor J. A. Fleming, F.R.S.

The portrait of Professor J. A. Fleming, which has been painted by Sir William Orpen, R.A., will be presented to University College, London, on Wednesday, November 30th, at 5 p.m. The presentation will be made by the chairman of the Fleming Portrait Fund Committee, Mr. A. A. Campbell Swinton, and will be received on behalf of the College by the chairman of the College Committee, the Viscount Chelmsford, and the Dean of the Faculty of Engineering, Professor E. G. Coker. Mr. Campbell Swinton will also present to Professor Fleming a copy of the portrait. Professor Fleming has intimated his intention of presenting this copy to the Institution of Electrical Engineers. Tickets for the presentation ceremony at University College on November 30th may be obtained by sending a stamped addressed envelope to the assistant secretary of the College.

London and Home Counties Joint Electricity Authority.

At a meeting of the London and Home Counties Joint Electricity Authority held on November 7th, a report and recommendations of a special sub-committee that was appointed to consider the South-East England Electricity Scheme, 1927, were considered. In presenting the report, a joint meeting of the Finance and Technical Committees of the Authority drew the Authority's special attention to the proposal contained in the scheme to sanction the erection of the new generating station at Battersea by the London Power Company, Limited, in advance of the erection of the station at Chiswick by the Authority, "the need for the immediate erection of which has never hitherto been questioned by any competent authority. Neither the scheme itself, nor the supplementary particulars in support of the scheme, published by the Central Electricity Board, show reasons why the erection of the Chiswick station should be postponed."

The Committees recommended, *inter alia*, that the Authority should be placed in the position of purchasing supplies from the Central Board on base-load selected station terms; alternatively, the Authority should be permitted to proceed with the Chiswick station without delay. That the methods indicated in the supplementary particulars for bearing the cost of the transmission system to be constructed and operated by the Authority be altered, as the effect of such methods would be to place an undue burden upon those authorised distributors taking supplies from the Central Board through the Authority. That in framing charges due regard should be given to the load factor and the power factor of the supply. As an alternative to the suggestions contained in the supplementary particulars that the capital cost of the transmission system to be constructed by the Authority should be borne by the Authority, the Central Board be asked to consider the advisability of the necessary financial arrangements being carried out as part of the capital expenditure of the Board. That the attention of the Central Board be called to the fact that the supplementary particulars, so far as they express the cost of individual development of authorised undertakers and savings to be realised by the operation of the scheme, do not take into account the Authority's scheme.

The J.E. Authority adopted its Committee's report and recommendations, submitted them to the Central Board, and appointed representatives to negotiate with the Board.

The Electricity Commission has finally approved of the erection of the Battersea station.

A Special Recording Map.

What should interest distribution engineers in connection with surveys for cable and line work is a waterproofed map which has been perfected by Messrs. EDWARD STANFORD, LTD. It is an ordinary map, but its surface is treated with a special varnish-like material which, it is claimed, is impervious to weather, oil and petrol. The important feature is that marks made on the treated surface with a fairly broad pointed pen or a special pencil supplied for the purpose can be easily wiped off, either with the finger or a damp cloth. This would, no doubt, prove particularly valuable for making records when marking out proposed line routes.

The New Premises of the E.A.W.

The new premises of the Electrical Association for Women, at 46, Kensington Court, London, W.8, were formally inaugurated by the President, the Viscountess Astor, M.P., on November 14th. Most appropriately, the new home of the Association is on the site of the first generating station to be erected in London, the ground floor still being used as a sub-station by the Kensington and Knightsbridge Electric Lighting Co., Ltd. In addition to office accommodation, a club room has been provided for members, and a model electric kitchen, which will also be used for lectures and demonstrations. The premises have been wired throughout for electric lighting and heating, and the whole of the equipment has been given by a number of leading electrical firms. The main

The E.A.W.'s Model Electric Kitchen.

feature is the electric kitchen, which is shown in the accompanying illustration. This is equipped with an electric cooker, storage and instantaneous water heaters, washing machine, vacuum cleaner, refrigerator, and a number of other domestic appliances. The club room and offices are heated by electric fires of various designs, a sun-ray standard and electro-vapour radiator also being included. In addition to providing comfort for the members, the premises should assist in promoting the interest of women generally in the uses of electricity in the home.

The Manchester Branch of the Association recently visited the Manchester showrooms of Messrs. Berry's Electric, Ltd., when Mr. A. Shelton gave an instructive talk entitled "A Simple Explanation of Electrical Units in Domestic Supply."

The winter season of the Glasgow and District Branch of the Association was inaugurated on November 9th, when Mr. D. M. MacLeod, chairman of the Scottish Centre of the Institution of Electrical Engineers, read a paper on "The Electricity Supply Act of 1926 and what it means to the public."

National Institute of Industrial Psychology.

A meeting will be held on Friday, November 25th, at 5.30 p.m., in the hall of the Royal Society of Arts, London, when certain of the Institute's investigators will describe "How Psychology Enters into the Institute's Factory Investigations." The chair will be taken by the Earl of Balfour, K.G., O.M., F.R.S., President of the Institute.

Machine Tool and Engineering Exhibition, 1928.

We are informed that already 90 per cent. of the ground-floor space at Olympia, and a considerable part of the gallery, has been allocated to firms participating in the Machine Tool and Engineering Exhibition which is to be held in September next year. The exhibition is held under the auspices of the Machine Tool Trades Association, 70, Victoria Street, S.W.1.

Appointment Vacant.

Chief engineer for the Government of Ceylon electricity undertaking. (See our advertisement pages to-day.)

Light and Heat in Medicine.

Sir Alfred Mond will open the first International Exhibition of Light and Heat in Medicine, Surgery and Hygiene, which will be held at the Central Hall, Westminster, December 13th-16th inclusive. An important conference will be held in connection with the exhibition, at which eminent medical and scientific men will discuss a number of questions arising out of the new methods of healing which have for their basis the use of light rays, ultra-violet rays, heat rays, and X-rays. Exhibition space will be devoted to a comprehensive display of heat, light, and ultra-violet ("artificial sunlight") lamps, and certain drugs and preparations which are now used conjointly with the rays. The exhibition and conference have been organised by the *British Journal of Actinotherapy*, 17, Featherstone Buildings, London, W.C.1, to which those who wish to attend the conference should make application.

Radiological Research at Woolwich.

In his introduction to R.D. Report No. 71 (H.M. Stationery Office, price 1s. 6d. net), Mr. V. E. Pullin, director of radiological research, explains that it records the progress and use of general radiological research in the fighting services, and that it indicates the beginning of the more important lines of investigation which have been developed for practical service purposes. For example, the routine examination of fuses and castings is now an accomplished fact, but many of the X-ray spectroscopic investigations which have been done, or are still in progress, deal with subjects of a confidential nature; no specific reference has been made in the report to such researches. Experimental opaque cordite was examined for air bubbles; large numbers of boiler plates were examined for hidden cracks; the experimental construction of armour-piercing bullets was aided by radiography to a considerable extent, as was also the development of anti-aircraft bullets of special types. Serious breakdowns had been experienced with the commercial transformers originally purchased from the trade; the question therefore of producing a transformer capable of continuous operation received special attention, and a 300-kW set was made in February, 1919. At that time the Department obtained a patent covering the special design of rectifier which was evolved: the secondary of the transformer was split up into a great number of sections and a rotating segmented spindle was constructed to revolve synchronously; each segment was designed to rectify each separate section of the secondary and the apparatus was fitted with suitable collecting terminals. Experiments were conducted with a view to making an X-ray film insensitive to visible light, and at the same time sensitive to X-rays; the work was directed to efficiency in factory X-ray practice, and the experiments were successful. As the need for still higher voltages for experimental purposes became apparent the existing transformer was reconstructed on a somewhat new principle, designed to deliver a voltage of 400,000 volts. The above are only a very few examples of the important work that has been carried out at Woolwich. Modification and development of the special photographic emulsions are called for by this particular radiological development, and important researches which urgently demand attention are concerned with the improvement of fluorescent screens and the investigation of fluorescent materials in general. The director has been called upon very largely in a consultive capacity by other Government departments and X-ray equipment in the Naval, Army, and Royal Air Force hospitals has been completely reorganised under his direction from safety and efficiency points of view. The fact that all crystalline explosives are suitable subjects for X-ray spectroscopic investigation has led to intense specialization in this work, and similar investigations of metallurgical questions of service importance are also receiving diligent attention.

Electric Canal Haulage in France.

A system of electric barge haulage is in operation on the canal between Etrun and Bethune in the Pas de Calais mining district of France, over a distance of about 47¼ miles. The system is operated by the Compagnie des Mines d'Anzin, the coal-carrying barges being hauled by electric tractors weighing 9¼ tons and running on rails, the travelling speed being 2¼ miles per hour, although when running light a speed of 8¼ miles per hour can be attained. The tractors, which collect power from a 500-V, d.c. overhead line, work in sections of 765 yards, means being provided for quickly changing over the towing ropes from one tractor to another.

Electricity in South African Coal Mines.

The application of electrical power to the winning of coal in the main fields is at present on the increase in South Africa, particularly the Witbank field, where a number of pits are taking, or preparing to take, their power requirements from the Commission's mains, fed from the new Witbank station; a fourth 20,000-kW set will be added to the plant in that station without delay. Most African pits are, fortunately, comparatively free of gas, but there is always the dust question to be considered. Where shall the South African engineer turn for the desired safety? So far the Union does not possess an electrical code for colliery work, but in no country has the subject received more thorough attention than in Great Britain, and a system of testing and certifying apparatus as safe has been organised by the Home Office, which also has a most complete set of regulations designed to safeguard the coal miner. A Home Office certificate that a switch is flame-proof conveys to the purchaser and the user a definite assurance of safety, and it is of considerable interest to learn that this line of reasoning has carried weight with those responsible for the electrical equipment of the new working of the Witbank Colliery, for this equipment will be designed to pass the Home Office tests and to carry with it that Office's certificate. The *S.A. Mining and Engineering Journal* commends the practice to coal owners who are electrifying, but "would hesitate to suggest that our ever-ready legislators should be invited to give this matter their attention. One of the most prominent features in our industry to-day is the safety-first movement, and we feel sure that this movement will continue to operate from within the industry, without the need for legislative interference."

American Electric Liners.

The s.s. *California*, the largest electrically-driven passenger vessel in the world, which, as already announced, was launched on October 1st, at Newport News, Va., U.S.A., is the largest commercial steamship to be built under the American flag and lies in the yards of the Newport News Shipbuilding and Drydock Company. She is being built for the Panama Pacific Line, a subsidiary of the International Mercantile Marine Company, for inter-coastal trade on a 5,500-mile run between New York and San Francisco, *via* Havana and the Panama Canal, carrying both passengers and freight. This boat will be completely electrified and thoroughly fitted with up-to-date appliances and conveniences for its passengers. Delivery to the owners is expected to take place next January; meanwhile, contracts have been let for a second ship, practically identical, to be constructed by the same company in the same yard, and still another vessel of the same type is contemplated. The *California* and its sister ships will be driven by the turbine-electric method of propulsion, using electrical machinery throughout furnished by the General Electric Co. of America. The main power plant will consist of two marine-type steam turbines, each rated at 6,750 shaft horse-power, 2,640 r.p.m., the latter corresponding to approximately 110 r.p.m. propeller speed; each turbine will have a maximum capacity of 8,500 shaft horse-power, 2,880 r.p.m. (120 r.p.m. propeller speed), and will each be directly connected to an alternating-current generator rated at 5,250 kilowatts, 2,640 r.p.m., 3,700 volts, 3-phase, having a maximum continuous rating of 6,600 kW at 4,000 volts. There will be two main propulsion motors, one directly-connected to each propeller shaft, each being of the synchronous induction type, rated at 5,250 kilowatts, 110 r.p.m., 3,700 volts, 3-phase, 5,750 h.p. The maximum continuous rating of each motor will be 6,600 kilowatts, 120 r.p.m., 8,500 shaft horse-power. Ventilation for the propulsion motors will be supplied by four direct-current, motor-driven exhaust fans automatically controlled and each normally giving 20,000 cubic feet of air per minute. The propulsion machinery will be controlled through a main operating panel divided into two sections, one for main high-voltage control and the other for low-voltage control of the field circuits. Steam will be provided by 12 Babcock & Wilcox water-tube boilers at a pressure rating of 275-lb. gauge and a superheat of 120 deg. F.; they will be operated under forced draft with double-front furnaces equipped with Peabody burners; the exhaust steam will be condensed.

The ships will be completely equipped with all necessary electrical auxiliaries for passengers, cargo and crew, including elevators, dumb waiters, electric cooking equipment, deck cargo-handling gear, boat-handling equipment, warping winch, &c. Power for all the auxiliaries, including the refrigerating plant and the lighting, will be supplied by four 500-kilowatt turbine-driven generators which will furnish direct current for this purpose and for exciting the propulsion motors. They will have refrigerating plant of the CO_2 compression type, with motor-driven brine-circulating pumps.

A Large Electric Generator.

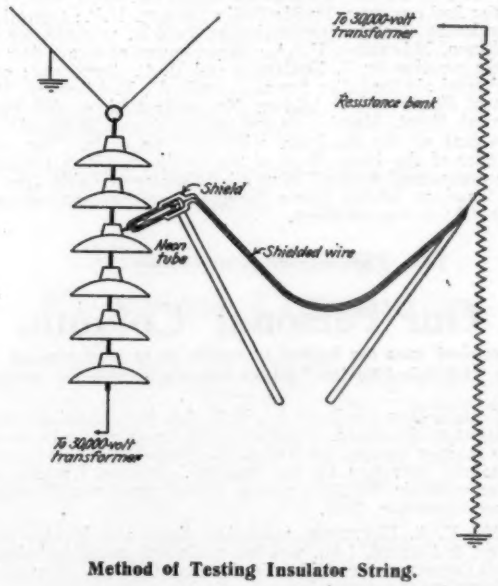
An electric generator rated at 160,000 kilowatts is to be installed by the New York Edison Co. in its generating station at 14th Street and East River. It will be driven by a tandem-compound steam turbine, which means that all the equipment will be mounted on a continuous shaft, including a single-flow high-pressure turbine element, a double-flow low-pressure turbine element, the electric generator, and a directly-connected exciter. The generator will be of 1.00 power factor, 1,500 r.p.m., 3-phase, 25 cycles and 11,400 volts. The turbine will receive steam at a pressure of 400 lb. and a temperature of 700 deg. F., and will exhaust at one inch absolute pressure. The entire set will be 82 ft. 7 in. long and will weigh 2,228,000 lb., well over a thousand tons. Installation of the equipment will be completed by October 1st, 1928, and it will be manufactured in the Schenectady plant of the General Electric Co. of America, where the two 60,000-kilowatt sets in service in the 14th Street station were made. The New York Edison Co. is also obtaining from the General Electric Co. of America the necessary transformers and two 40,000-kilowatt frequency-changing sets of the synchronous-induction type, like two others already installed on the Edison and allied companies' system, employed to make available, where needed, any margin of 25- or 60-cycle capacity, to exchange power with outside systems through existing and contemplated new inter-company ties, and possibly to utilise water power in the metropolitan district.

In a recent talk broadcast from WRNY, New York, Mr. Arthur Williams, of the New York Edison Co., made the following statement:—"A single generator now in course of construction for the New York Edison Company, alone has a capacity greater than the electrical demands upon all of the central stations of the City of London."

The expression "all of" can only be used in connection with a greater area than the "Square Mile," for only two stations actually serve the city and another a very small portion (Metropolitan Co.). Mr. Williams evidently intended his listeners to think that the 160,000-kW set to which he referred was far greater than the whole of the plant in the Metropolitan area, or even Greater London. Now the Metropolitan Borough Councils alone recorded an aggregate maximum demand of 168,559 kW in 1924-25, while that of the London companies was 340,686 kW in 1925. This takes no account of the outlying areas of the London and Home Counties Electricity District, which district in 1924-25 had an aggregate maximum demand of over 606,000 kW.

Insulator Voltage Distribution Measurement.

In an article on "Voltage Distribution Over Insulators," by Mr. Frank E. Reeves, published in the *Electrical World*, a method is described of determining the voltage distribution along a string of porcelain insulator units under high pressure, whereby the difficulties of the ordinary methods of instrument measurement are claimed to be overcome. The idea is to balance the test points of the insulator against the corresponding points on a resistance potentiometer. The accompanying illustration depicts the arrangement of the apparatus used. The indicating device consists of a Westinghouse "spark C" neon tube. This is mounted on the end of a stick. That part of the rubber cylinder surrounding the enclosed



Method of Testing Insulator String.

electrode is covered with tinfoil which is connected to a brass probe at the end of another stick. The wire is shown shielded, but this has been found to be unnecessary. There is no disturbance in the insulator currents due to capacitance when balance is obtained, and the capacitance effects between the shield and earth are negligible. At the point of balance, of course, there is no glow in the tube. The exact magnitude and phase of the voltage across a defective unit may be obtained by placing capacitance across that part of the resistance bank corresponding to the good units.

Electricity in Agriculture.

On Wednesday an important report was to be submitted to the Conservative Agricultural Committee of the House of Commons, relating to electricity in rural areas, by Sir Douglas Newton, M.P., and Sir Mervyn Manningham-Buller, M.P. The report emphasises the necessity of facilities to erect overhead lines cheaply, and the importance of the part that farmers' associations can take in electrical development.

The Great Electrical Hare Competition.

The following dogs are left in the contest after running in the third heat:—Osram, 5; Monach, 10; Centralisation, 30; and Tricky Tricity, 48. The total number of hares caught to date is 6,058.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the meeting held on November 7th, a discussion on "Recent Developments in Electro-Medical Appliances" was opened by Mr. C. H. Holbeach. Mr. W. E. Highfield was in the chair. The speaker analysed the ground covered by these appliances into four sections: Medical, therapeutic, diagnostic, and pain alleviating; and enlarged on each, comparing the attitudes of the public, the engineer, and the medical profession towards their use. He explained in detail the various methods of treatment, and described the apparatus and the effects produced. He next dealt with new developments, and elicited a fruitful and interesting discussion, the salient points of which were the unheeding attitude of the medical profession, the increasing public demand for treatment, and the need for investigations in the subject of biophysics.

Royal Institution.

On Tuesday next (November 22nd), at 5.15 p.m., Sir William Bragg will deliver the first of a course of four lectures at the Royal Institution on "A Year's Work in X-Ray Crystal Analysis."

Junior Institution of Engineers.

At the annual general meeting of the Institution, held on Friday last, the following officers were elected for the session 1927-28: Chairman, Mr. W. M. Hurrell; vice-chairmen, Messrs C. E. Atkinson and S. H. Hole; hon. treasurer, Mr. R. L. Kirlew; hon. librarian, Mr. P. L. Mullings; members of Council: Messrs. E. Ambrose, H. S. Rentell, R. D. West, and (junior member) B. J. Axten.

Institute of Fuel.

Included in the papers which are to be read and discussed at the autumn meeting of the Institute of Fuel, to be held at the Institution of Electrical Engineers on November 23rd and 24th, are: National electricity supply and better utilisation of our fuel resources, by Sir Philip Dawson, M.P.; Operating experiences of steam production at 1,300 lb. pressure, by J. Anderson, Milwaukee, U.S.A.; Measurement of steam flow in works practice, by T. Nordenson and H. C. Armstrong; and Preheated air for boiler furnaces, by P. H. N. Ulander. The annual dinner will be held on November 23rd, at the Great Central Hotel, Marylebone, when Sir Alfred Mond, M.P., president of the Institute, will take the chair. The first number of the *Proceedings* of the Institute, which contains the papers read at the 1926 meeting, is now available, free to all members joining before December 1st, 1927, and on sale (10s. 6d.) to non-members.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Captain DOUGLAS HACKING, M.P., has been appointed Parliamentary Secretary, Department of Overseas Trade, to fill the position vacated by Mr. A. M. Samuel, who has become Financial Secretary to the Treasury. Captain Hacking has been with Sir William Joynson Hicks, the Home Secretary, since December, 1925.

Mr. E. A. HAILWOOD, managing director of Messrs. Hailwood & Ackroyd, Ltd., was last week nominated as independent Conservative candidate in the Southend by-election which takes place to-morrow (Saturday).

At the annual dinner of the Stockport Corporation electricity works staff last week several presentations were made. Mr. C. H. WARD, mains engineer, was presented by his fellow employés with a gold wristlet watch to mark the completion of 21 years' connection with the undertaking. Mr. R. H. Lee, deputy engineer, made the presentation. Three employés bearing the name of SMITH—one a draughtsman, one from the clerical department, and the third a fitter, received wedding presents consisting respectively of a suitcase, a barometer, and a timepiece.

The Bristol Town Council has been recommended by the Salaries Committee to increase the salary of Mr. F. W. PROSSER, sales manager and secretary of the Electricity Department, from £700 to £800 per annum, having regard to the rapid growth of the undertaking.

Mr. H. WORSDALL is resigning his position of sales engineer to the Riley Stoker Co., Ltd., London, to take up a new appointment as head sales engineer with Brook Motors, Ltd., Huddersfield. Mr. Worsdall was previously engaged as sales engineer with the Electric Construction Co., Ltd., and Messrs. Siemens Bros. Dynamo Works, Ltd. (English Electric Co., Ltd.).

Mr. A. B. MALLINSON delivered his address as chairman of the North-Western Centre of the I.E.E. on November 1st. After receiving his technical education at the Manchester College of Technology, he served his apprenticeship with the Edison & Swan Co., and with Messrs. Mather & Platt, Ltd. He was with Messrs. Mather & Platt for 17 years altogether, and was closely connected with their electrical and hydraulic departments. He left them in 1911 to join his father's business (Messrs. Mallinson & Eckersley, Ltd., woodworkers). The firm are large manufacturers of cable drums and wood channelling or casing for wiring systems. Mr. Mallinson also, at that time, started consulting work, which he is still carrying on, specialising in industrial power and heating equipments. In this capacity he has installed many heat extraction power plants in paper mills and textile factories. He is also a director of the Mazapil Copper Co., Ltd., which operates extensive copper, lead and coal properties in Mexico. Mr. Mallinson is a member of the Institution of Electrical Engineers, of the Institution of Mechanical Engineers, of the Paper Makers' Technical Association, and of the Textile Institute.

Elliott & Fry [*London.*

Mr. A. B. Mallinson,
Chairman of the North-Western Centre of the I.E.E.

Mr. EDWIN SEDDON, engineer and manager of Edinburgh Corporation Electricity Department, presided at a gathering at Portobello power station on Friday, when Mr. John Ramsay, on the occasion of his retirement after 31 years' service, was presented with a gold watch and chain and a wallet of Treasury notes.

The Northampton Town Council has appointed Mr. H. SYKES, chief assistant to the tramway manager, as the manager's deputy, and has advanced his salary from £260 to £300 per annum.

The Woolwich Borough Council has decided to increase the salary of the borough electrical engineer (Mr. G. W. KEATS) from £1,314, including bonus, to £1,544 per annum.

Mr. A. H. DARKER, chief electrical engineer of Messrs. J. Stone & Co., Ltd., of London, left England on the Orient Liner "*Orama*" on November 12th for a world tour.

Bangor City Council has advanced the salary of Mr. C. H. GOODWIN, the assistant electrical engineer, by £26 per annum.

Alderman THOMAS EDWARD HIGHAM, chairman of the Mid-Lancashire Electricity Board, has been installed as the new Mayor of Accrington.

MR. HUGH PATERSON, the chairman of the North-Eastern Centre of the Institution of Electrical Engineers, who delivered his address on October 24th, was born at Glasgow. He was educated at Allen Glens' School and the Glasgow and West of Scotland Technical College, and gained

Jas. Bacon & Sons] [*Newcastle.*

Mr. Hugh Paterson,
Chairman of the North-Eastern Centre of the I.E.E.

his engineering training with Messrs. Mavor & Coulson, of Glasgow, and Messrs. Mather & Platt, Ltd., of Manchester. He joined the Metropolitan-Vickers Electrical Co., Ltd. (then the British Westinghouse Co.), in 1902, and has been with that company right down to the present time. He is manager for the company in the Newcastle district, his area comprising Northumberland, Durham, Westmorland, Cumberland, and the North Riding of Yorkshire, and he is a director of the Metro-Vick Supplies, Ltd.

Mr. W. R. MONTGOMERY, manager of the Alton Battery Co., Ltd., who has recently been elected vice-chairman of the Alton and District Chamber of Commerce, stated at a dinner of the Chamber that at a date not far distant his company's enterprise would be one of the largest in the Alton district.

During the hearing of a case at the Old Bailey Sessions recently the Recorder congratulated Mr. A. E. MCCLOSKEY, the prosecuting counsel, on the masterly way in which he had marshalled the facts of the case in his address. Before going to the Bar Mr. McCloskey was an electrical engineer for thirty years on the staff of the G.P.O. London, and his services were loaned by the P.M.G. to the Governments of India, Ceylon and the Irish Free State.

Mr. C. E. STROMEYER, chief engineer to the Manchester Steam Users' Association, is retiring after 30 years' service with that body.

Mr. RUSSELL F. FERGUSON, the retiring borough electrical engineer at Hastings, has been presented by the staff with a cabinet wireless set, and with an electric jug for Mrs. Ferguson.

Obituary.—DR. A. WICHERT.—The death occurred, on October 21st, at the age of 46 years, of Dr. Ing. Alfred Wichert, a director of the Brown-Boveri Co., Mannheim, Germany.

MR. D. L. DAVIES.—We regret to record that Mr. Daniel Lake Davies, manager of the Ammanford Electricity Works, died suddenly on November 5th.

Mr. P. R. ALLEN.—We regret to record the death of Mr. Percy Ruskin Allen, O.B.E., A.M.I.C.E., M.I.M.E., M.I.E.E., late of Runcorn, Cheshire, who passed away in a London nursing home on November 7th at the age of 72 years. Many years ago Mr. Allen was engineer to the Anglo-American Brush Electrical Company and it is stated that he had charge of the first public electricity supply plant in Great Britain, which served the City of London and lit the Charing Cross and Waterloo railway stations. After filling the office of manager to Woodhouse & Rawson and an engagement with the Aluminium Co., he became engineer of the Castner-Kellner Alkali Co., Ltd., when it was formed. Recently he had been chief engineer and works manager to that company at Western Point. He had acted as consulting engineer in connection with large power plants, and was specially concerned with the development and operation of large gas engines for electric power installations.

Wills.—The late Mr. D. J. PENNINGTON, a director of Gilbert Gilkes & Co., Ltd., of Canal Iron Works, Kendal, left £10,783 gross and £8,314 net personalty.

The Times reports that Mr. ALFRED C. TAYLOR, of Trinity Street, Peterborough, secretary and radiographer of the Peterborough Infirmary, who died on July 26th, from the effects of dermatitis contracted in his X-ray work, left estate of the gross value of £1,276, with net personalty £1,165.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Sunbeam & Sunshine, Ltd.—Private company. Registered November 4th, in Belfast. Capital, £100 in £1 shares. To carry on the business of general, electrical, and telephonic engineers, &c. The first directors are:—H. R. Gray, 46, Church Street, Portadown, commercial traveller; Mrs. K. E. Gray, 46, Church Street, Portadown. Registered office: 46, Church Street.

Bristol Wireless Co., Ltd.—Private company. Registered November 8th. Capital, £100 in £1 shares. Objects: To acquire the business of wholesale factors of wireless goods now carried on by W. G. Silcocks and L. W. Silcocks at Radio House, Queen's Road, Bristol, as the "Bristol Wireless Company (Wholesale)," and "The Bristol Wireless Company." The permanent directors are:—W. G. Silcocks and L. W. Silcocks, 77, St. Alban's Road, Bristol.

Ellancee Radio, Ltd.—Private company. Registered November 7th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers, hirers and maintainers of and dealers in all kinds of apparatus used in connection with the transmission or reception of radio waves, or any wave motion, &c. The permanent directors are:—F. J. Cowlishaw, "Radiola," Shardlow, Derby, radio engineer; A. T. Lee, The Court, Alvaston, Derby, electrical engineer.

Official Returns of Electrical Companies.

Westinghouse Brake and Saxby Signal Co., Ltd.—Debenture charged on freehold properties at York Road, Kings Cross, and Chippenham, Wilts, and the company's undertaking and property, present and future, including uncalled capital, dated October 31st, 1927, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

"Signs of the Times," Ltd.—Particulars filed of £100 debentures authorised October 21st, 1927, charged on the company's undertaking and property, present and future, including unpaid calls and liability of members, the amount of the present issue being £50.

Hewittic Electric Co., Ltd.—Particulars filed of £10,000 debentures authorised October 7th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Radio Service (London), Ltd.—Satisfaction in full on October 15th, of debenture dated July 25th, 1927, securing £125.

Wark and District Electric Lighting Co., Ltd.—Capital, £1,500 in £1 shares. Return dated July 6th, 1927. All shares taken up. £1,500 paid. Mortgages and charges nil.

Woodhall & Partners, Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1926 (filed August 5th, 1927). 1,530 shares taken up. £1,530 paid. Mortgages and charges nil.

Electromobile Engineering Co. (West Bromwich), Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed June 15th, 1927). 482 shares taken up. £482 paid. Mortgages and charges nil.

H. H. Hornsey, Ltd.—Capital, £1,000 in £1 shares. Return dated November 12th, 1926 (filed May 25th, 1927). 625 shares taken up. £282 paid. £343 considered as paid. Mortgages and charges nil.

Hestavox, Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1926 (filed May 27th, 1927). 3,004 shares taken up. £3,004 considered as paid. Mortgages and charges nil.

Radio-Acoustics, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1926 (filed April 26th, 1927). All shares taken up. £4,004 paid. £5,996 considered as paid. Mortgages and charges nil.

Sel-Ezi Wireless Supply Co., Ltd.—Capital, £500 in 400 preference shares of £1 each and 2,000 ordinary shares of 1s. each. Return dated March 29th, 1927 (filed May 16th). 270 preference and 2,000 ordinary shares taken up. £370 paid. Mortgages and charges nil.

Warwickshire and South Midland Electricity Supply Corporation, Ltd.—Capital, £12,500 in 12,000 preference shares of £1 each and 10,000 ordinary shares of 1s. each. Return dated January 12th (filed April 26th), 1927. 11,973 preferred and 7,847 ordinary shares taken up. £12,365 7s. paid. Mortgages and charges: £12,000 debentures.

Bath Electric Tramways, Ltd.—Capital, £230,000 in 75,000 preference, 125,000 preferred ordinary, and 30,000 deferred ordinary shares of £1 each. Return dated April 7th, 1927. 75,000 preference, 75,606 preferred ordinary, and 30,000 deferred ordinary shares taken up. £150,606 paid. £30,000 considered as paid. Mortgages and charges, £113,219.

London Platino-Brazilian Telegraph Co., Ltd.—Capital, £400,000 in £10 shares. Return dated May 26th, 1927. 37,480 shares taken up. £374,800 considered as paid. Mortgages and charges nil.

National Electric Construction Co., Ltd.—Capital, £125,000 in 10s. shares. Return dated May 12th, 1927. 170,000 shares taken up. £75,574 10s. paid on 151,149 shares. £9,425 10s. considered as paid on 18,851 shares. Mortgages and charges, £75,000.

Urban Electric Supply Co., Ltd.—Capital, £640,000 in 240,000 ordinary, 350,000 preference, and 50,000 shares of £1 each. Return dated May 26th, 1927. 240,000 ordinary and 350,000 preference shares taken up. £490,000 paid on 240,000 ordinary and 250,000 preference shares. £100,000 considered as paid on 100,000 preference shares. Mortgages and charges, £350,000 5½ per cent. debenture stock; and £278,707 4½ per cent. debenture stock.

Beko Lamp Co., Ltd.—Second debenture dated October 31st, 1927, to secure all moneys and liabilities, now or hereafter due, from or incurred by the company, charged on the company's undertaking and property, present and future, including uncalled capital, subject to a debenture in favour of Barclay's Bank, Ltd. Holder: J. Meech, 95, Mayon Road, Sydenham, S.E.26.

Mersey Cable Works, Ltd.—Mortgage dated October 29th, 1927, to secure £12,500, charged on leasehold land and factory in Linacre Lane, and Selkirk Road, Bootle. Holders: Astral Shipping Co., Ltd., 601, Tower Building, Liverpool.

City Notes.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd.

The directors' report for the year ended August 31st, 1927, shows that, after making provision for doubtful debts and income-tax, there was a net loss of £45,476. The balance brought forward from the previous year was £59,678. The dividend on the ordinary shares paid in December, 1926, was £37,500, and the dividend on the preference shares paid in January and July £12,500, leaving £9,678. There is to be transferred from the reserve fund £50,000, making £59,678, less loss as above, £45,476, leaving £14,202 to be carried forward. The report says:—"The disappointing results of the past year's trading, which were partly foreshadowed in the circular issued in June last, appear to be mainly due to the after-effects of last year's labour troubles. The company's business has not greatly diminished in value—in some important directions it has increased—but our prices in many cases had to be reduced to maintain the turnover, thereby affecting profits. To cover the loss on the year's work, the directors have withdrawn £50,000 from the reserve fund, leaving £265,000 to the credit of that fund and £14,202 to be carried forward. The French factory, apart from the loss arising out of the stabilisation of the franc, is still giving considerable anxiety to your board, and important changes are being made to arrive at satisfactory results. The company's foreign branches were able to show a fair profit and the general foreign business is expanding. Submarine cable work has been difficult to obtain. The *Silvergray* has had little employment during the year, but she is, of course, ready at any moment to undertake work. The company has faced even more difficult times than these, and your directors are confident that the present depression will pass. Silvertown is in an efficient and healthy condition, and in various directions there are good prospects of new and profitable business. The directors feel, however, that it would be unwise to recommend a dividend on the ordinary shares, but the preference dividend due on January 1st next will be paid as usual. Your directors wish to record the loss they and the company have sustained by the death, in June last, of Mr. Stuart A. Russell, the works manager at Silvertown, and an extraordinary director of the company." Annual meeting: November 24th, at 106, Cannon Street, E.C.4.

Perak River Hydro-Electric Power Co., Ltd.

The first ordinary general meeting of the company was held on November 8th, Lord Elibank (chairman) presiding. In presenting the report (*vide* our last issue, p. 829) the chairman said that the period under review had been one of strenuous endeavour to build up the undertaking upon a solid foundation to enable it to cope with the demands of the tin-mining and other industries in the area. Mr. John Ferguson, late chief electrical engineer to the East Indian Railways had been appointed general manager, and Mr. C. I. Thulin, who had had considerable experience in the type of dam and works which the company was constructing, had been selected as resident engineer in charge of construction. As stated in the report, practically the whole of the contracts for the construction of the hydro-electric and steam stations and the transmission and distribution system, as originally contemplated, had been placed. The contractors for the construction, Messrs. Topham, Jones & Railton (1926), Ltd., were making every endeavour to complete the work by the stipulated date, October 1st, 1929. After dealing with the progress of the work of construction, the chairman said that it had been necessary to enlarge the plans for the steam station and instead of one 5,000-kW set, three 6,000-kW turbo-alternators were to be installed. The supply from this station would enable revenue to be earned at a much earlier date than was originally contemplated and would secure to the company customers who would have been forced to make other arrangements if the supply had not been available.

Mexican Light and Power Co.

The report for the past year states that although conditions in Mexico were quieter than for some years past, there was continued trade depression owing to the uncertainty of stability. In the company's territory quietness reigned during the year. The gross earnings for the year (including uncollected accounts for services rendered during 1926 to the municipal and federal authorities) were $19,714,021 (Mex.), against $18,569,527 in 1925. The total expenses rose from $9,477,587 to $10,184,279, and the net income from $9,091,940 to $9,529,742, an increase of $437,801.

Prospectus.

Tarfroid, Ltd.—An issue at par of 150,000 8 per cent. cumulative participating preference shares of 10s. each and 150,000 ordinary of 1s. each in this company was offered this week, the list to close on November 17th. The company has been formed to purchase the business, &c., of Tarkold, Ltd., and to exploit its patent rights for its products known as "Tarfroid," "Tarkold," "Mac-kold," and "Plycold." "Tarfroid" is a tar product made under a special formula for road making and maintenance; it is claimed to be useful in water-proofing, wood preservation, electric cable manufacture, &c.

British Electric Traction Co., Ltd.

Interim dividends of 3 per cent. on the 6 per cent. cumulative participating preference stock and 4 per cent. on the 8 per cent. non-cumulative preferred stock have been declared.

Bogota Telephone Co., Ltd.

The report for the year ended June 30th last records a gross revenue of £45,612 and working expenses of £21,724, leaving a profit of £23,888, as compared with £23,063 in the preceding year. With £8,265 brought forward the amount available is £32,153. Of this £5,000 is transferred to depreciation account, a final dividend of 7½ per cent., making 12½ per cent. for the

year (as for 1925-26) is recommended and £9,202 is carried forward. The existing equipment at Bogotá is working at its full capacity, and there is a waiting list. Extensions sufficient to meet all demands are being actively proceeded with. Since the end of the financial year a further 114,886 shares have been issued at 25s. each. Meeting: November 25th.

Sir William Arrol & Co., Ltd.

The accounts for 1926 show a loss of £116,702, which, added to a deficit brought forward, makes a total of £175,990. The directors propose to meet this by writing down the value of the £10 ordinary shares to £6. The preference dividend would at the same time be increased from 6½ to 7 per cent. in satisfaction of arrears. After the reduction the ordinary capital will be raised to £800,000.

Mexico Tramways Co.

The gross earnings for 1926 amounted to $9,931,280 (Mex.), as compared with $9,997,033. The total expenses decreased from $10,527,288 to $9,852,776, and against a deficit of $530,255 in 1925 there were net earnings of $78,504. The ratio of operating expenses to earnings fell from 92.11 to 89.82 per cent.

Stock Exchange Notice.

The undermentioned have been ordered to be officially quoted :—

Notting Hill Electric Lighting.—8,598 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 2,998 and 14,401 to 20,000.

Coventry Chain Co., Ltd.

A final dividend of 5¼ per cent. has been declared on the ordinary shares, making 7¼ per cent. for the year (against 10 per cent.). The profit for the year ended August 31st last was £47,596, against £52,021.

Chiswick Electricity Supply Corporation, Ltd.

At an extraordinary meeting held on November 10th a resolution providing for the doubling of the capital was approved. This involves the creation of 100,000 new £1 shares.

John I. Thornycroft, Ltd.

For the year ended July 31st the ordinary shares are to receive 6 per cent., as compared with 3 per cent. for 1925-26. The carry forward is slightly increased at £51,670.

Cawnpore Electric Supply Corporation, Ltd.

An interim dividend of 3 per cent. has been declared on the ordinary shares, as in 1926.

French Companies.

The *Société de Constructions Electriques de Nancy* reports net profits of 931,000 fr. for 1926-27, as compared with 704,000 fr. in the previous year. The dividend is increased from 40 fr. to 45 fr. per share.

The *Société des Etablissements Industriels Grammont* reports profits of 11,303,000 fr. for 1926-27, the whole of which has been applied to the writing-down of assets. The improvement in the finances of the company is stated to permit of a larger supply of raw materials being given to the works, enabling them to be put into full operation.

The *Société d'Electro-Métallurgie de Dives* records net profits of 18,504,000 fr. for 1926-27; the dividend is 115 fr. per share. Important modifications have been carried out at the works and in the organisation so as to improve efficiency. Satisfactory results have been obtained from the starting up of the electric furnaces.

Austrian Company.

The accounts of the *Cable Works and Wire Industry Company*, Vienna, show net profits of 420,000 schillings for 1926-27, as compared with 330,000 sch. in the previous year. The activity of the works is stated to have been materially better than in 1925-26. The export trade, which represented 30 per cent. of the total turnover in 1925-26, was hampered by the measures adopted by surrounding countries and the unfavourable transport situation. A sales agreement for insulated and plain conductor wires has been arranged with the Siemens and Halske Works and the Felten and Guilleaume Company. The dividend is 10 per cent., as against 7 per cent. in 1925-26.

Stocks and Shares.

MONDAY EVENING.

BUSINESS in the Stock Exchange markets is active enough to provide plentiful work in a number of the industrial sections. The boomlet itself may be rent, but although excitement has given way to more subdued conditions, public interest returns, perhaps a little spasmodically, to the stocks and shares which offer any reasonable chance of appreciation. People are quite frank nowadays in saying they want to buy something that is going up, and that dividends are secondary considerations. In times gone by, the admission would have been regarded as tantamount to a desire to speculate, which the serious deplored, and the austere labelled as gambling. *Mais nous avons changé tout cela.*

The Cable Disturbance.

There can be no doubt as to the disturbance produced in the minds of cable investors by the latest publicity accorded to the wireless competition. Radio rates are declared to be cheaper, radio messages quicker, than those handled by the submarine companies. On the other hand, the cable customers maintain that the older system is more dependable, reliable, secret. It can be found that, without their taking sides, two distinct sets of opinion are current in regard to the advantages enjoyed by the users of the air and of the submarine methods of communication. That the Government is bent upon popularising the Beam business is obvious from the scale of charges, and, with the taxpayers' money at the back of the Post Office, a war of rates might benefit those people who send and receive messages, but nobody else. The four principal companies affected, the Eastern Telegraph, Eastern Extension, Western Telegraph and Globe Telegraph are remarkably well fortified by substantial reserves. For years past the four have paid 10 per cent., tax-free, dividends upon their ordinary share capital, putting aside large sums to reserve and other accounts. The traffic-carrying companies—the Globe Telegraph and Trust is a holding concern, as the name implies—are in a position to sustain a material falling-off in profits before the present-paid rate of dividend is threatened. Nevertheless, that stockholders do not like the outlook is shown by further falls in Eastern ordinary, of 2½ points, of 7s. 6d. in "China" shares, and 5s. in Westerns. Globes are left unchanged at 17½.

Marconi Shares.

The Marconi Company has now received permission to reduce the capital in accordance with the plan proposed some time ago by the directors. The opposition elicited various interesting facts when the matter came before Mr. Justice Eve, but impartial reading of the case did not seem to reveal any particularly cogent reason for offering strong hostility to the scheme. An enormous sum of money has been lost: money that there seems little chance of recovering until the company's capital is brought more into consonance with the existing assets. Under favourable conditions, it might be possible to write up the capital at some future date, though the bare idea of such a thing may appear to be outside the bounds of likelihood for many years to come. The price of the shares, on the news that the capital reduction had been allowed, rose from 28s. to 29s. 6d., but on a moderate amount of selling, reacted to 27s. 6d. Canadians have been a poor market at 6s. 9d., and Marconi Marines went back sharply to 28s. 9d., showing 2s. 6d. loss. Great Northern Telegraphs lost £1 after their recent very considerable advance. Anglo-American Telegraph deferred is ¼ lower at 24¼, and the preferred ¼, at 103¼. United River Plate Telephones went back 5s. to 10¼. Anglo-Portuguese Telephones were changing hands fairly freely on the basis of 23s. 3d. before the price went ex dividend, 7 1/5d., last week. Montevideo Telephones are quoted at 40s., the last-recorded business in them being marked at 39s. 3d. early in April. Orientals are 1/16 down at 51s. 3d. The 7 per cent. preference shares stand at 22s. 6d., and the 4 per cent. redeemable debenture last marked 79½. In Automatic Telephones the price remains unaltered at 48s. Ever-Ready shares have gone back to 4 7/16.

Home Electrics.

Continued animation has again been the order of the day in the Electricity Supply market, although there are not many changes in prices to report. In the "Bulk Supply" section, Newcastle continued their rise, being at one time 24s. 0d., from which price they receded to 23s. 9d. The new are 1s. under this figure, and as the only difference between new and old is about 4d. per share in the final dividend, due next March, the new are the cheaper purchase of the two. Of the companies controlled by the London Electricity Act, Chelseas and County of London ordinary are both a trifle harder at 25s. and 28s., respectively. In this group there is available, at the moment, a small supply of County 5 per cent. debenture at 101½, and London Power 5 per cent. debenture at 98¼, the former free of stamp and fee. As they are both in the gilt-edged category, they are likely to be steadily absorbed. Folkestone ordinary have strengthened to 38s. 9d. and Scottish Power preference to 28s.

Edmundsons and Urbans have both been active, business being done during the week as high as 45s. and 40s., respectively. Their 1926 dividends were 10 per cent. and 7 per cent., and although results from the current year will probably show improvements, the current prices, in both cases, would appear to discount the future for some time to come. A large number of North Wales ordinary have changed hands during the week on the basis of 15s. to 15s. 6d., and are being put away by purchasers, confident that at this price the undertaking will presently repay them for waiting dividendless over the next two or three years.

Overseas Electrics.

Perak River Hydro Electric are 1s. better at 15s., responding to the cheerful speech of the chairman at the first annual general meeting held during the week. The report of the Mexican Light and Power Company made its appearance during the week. It shows a surplus, after providing for bond interest, of $3,069,976, against $2,781,015 for 1925. The 5 per cent. first bonds at 79½ and the 5 per cent. second bonds at 69½ are higher in consequence. Mexican Electric Light fives rose to 75½. Madras Electric at 33s. 9d. x.d. have well maintained their rise of the previous week, and Whitehall Electric 7½ per cent. preference changed hands a considerable number of times round about 21s. 3d. The company's debenture stock is 10s. better, at 102. Atlas Light and Power ordinary achieved further popularity, and at 17s. 6d. have more than recovered the dividend deducted last week. This company is about to issue £530,000 of 6 per cent. debenture at 99, and a similar amount of 7 per cent. £1 cumulative preference shares at 20s. 6d.

London and Other Trams.

Business in the shares of the London and Suburban and London United Tramway Companies has fallen off noticeably. A Bill for the co-ordination of the traffic of London has not been included in the Bills to come before Parliament this session. Assuming that it comes before the House in the spring session of 1928, and passes into law before the summer recess—which, under all the circumstances, would be rapid work—it is hardly likely to begin operating before January, 1929, in which case results would not be apparent until the reports for 1929 were published in March, 1930. It looks as if the shareholders in these two companies will have to possess their souls in patience for another 18 months or so. This should have become second nature to them by now, as they have done nothing else for the last three or four years. A sharp rise from 5s. 3d. to 7s. 3d. has taken place in the £1 ordinary shares of the Lancashire United Transport and Power Company. It is surprising that this has not occurred before, as for many months the traffics have shown persistent increases. British Electric Traction is a good market on the declaration of a 4 per cent., actual, interim dividend.

Overseas Trams.

Mexico Tramway shares went back to 23½ on the issue of the report. There was, again, a loss on the year, but less than for 1925. For the current year this company is receiving interest on a further £500,000 5 per cent. second bonds and on $11,775,859 6 per cent. income bonds which it holds in the Mexican Light and Power Company. As the interest upon this company's holdings in the Mexican Light and Power Company is sufficient to pay its own 5 per cent. first bond interest, with a margin of some $250,000, the present price of 76, giving a yield of approximately 6¾ per cent., does not appear over-valued.

Brazilian Traction Common at 202 have lost a couple of points, and the preferred drooped to 168, but British Columbia Electric Railway deferred at 189 and the preferred at 150 were both good spots, gaining 1 and 4½, respectively. The report of this company, due next month, is being awaited with considerable interest. La Plata Tramways £1 shares have been inquired for at 5s. 3d. It is understood that a scheme for dealing with the arrears of dividend on the preference shares will be forthcoming shortly.

India-Rubber Surprise.

India-Rubber shares are flat on the issue of a report exhibiting a loss for last year of £45,400, against a profit of £86,700 in the previous twelve months. The board have taken £50,000 from the reserve fund; they pay the preference dividend to July 1st, 1927, pass the ordinary dividend and carry forward £14,200, a reduction of £8,000. Next January's dividend on the preference is to be duly met. The chairman's speech, at the meeting on Thursday in next week, will no doubt afford reasons for the poor result of the last year's trading. At 12s. 6d. the price is 8s. down on the week. Siemens are easier at 30s., Callenders at 3⅞, and Henley's at 5 3/16. British Aluminium have improved to 2¼: there has been a little demand for them from the Continent. Engineering shares keep good, with a further rise to 3½ in Babcocks. Armstrongs hold their rises, and Vickers keep about 12s. 6d.

Underground Electrics.

The Underground group of Home Railways maintains its prices, but there is not much attention being paid at the moment to its stocks. Underground income bonds are better at 105. Speculation has a free run for indulgence in estimates of the likely dividend on the £1 shares of this company for 1927. The optimists profess that they will feel disappointed with anything less than 5 per cent., as compared with the 1½ per cent. paid in respect of last year. More cautious opinion points to the announcement, made last month, that an expenditure of 2½ million pounds sterling is contemplated over the next two years. This would justify the directors in adopting a conservative policy in connection with the dividend due for declaration early next year. In view of the lively speculation that there has been in the £1 shares, the dividend announcement will be awaited with an uncommon degree of interest.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Nov. 14 1927.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£ 1	14	14	58/9	+6d.	4 15 3
Brompton Ordinary	1	10	8¾	24/6	—	5 14 3
Charing Cross Ordinary	1	15	8½	26/-	—	5 7 8
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8⅝	25/-	+6d.	5 12 0
City of London	1	15	7½	28/9	—	4 17 5
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	7½	28/-	+1/-	5 0 0
do. do. 6% Pref.	1	6	6	23/-	+6d.	5 4 4
Edmundson's Ordinary	1	8	10	42/6	+2/6	4 14 4
do. 7% Pref.	1	6	7	24/6	—	5 14 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	1	15	8	25/6	—	5 9 10
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	8½	24/6	—	5 14 3
do. do. 6% Pref.	6	6	6	5⅝	—	5 11 3
Metropolitan	1	11	8	30/-	—	4 18 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	5½	6	24/-	—	5 0 10
Newcastle-on-Tyne Ordinary	1	7	5	23/9	—	4 4 3
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	26/-	—	5 7 8
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1¼	—	6 8 0
Urban Ordinary	1	7	7	1 1/16	+⅛	8 16 4
do. 6% Pref.	1	6	6	1 1/16	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/-	—	7 2 10
Yorkshire Elec.	1	8	8	32/-	—	5 0 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	8	60	—	5 0 0
do. District	,,	3½	3½	63½	—	5 10 3
Underground Electric	£1	Nil	1½	19/3	—	1 11 0
do. do. Income	Bonds 6	6		105	+1	5 14 3
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	109½	—½	5 15 11
do. Def.	,,	1½	1½	24⅜	- ⅛	6 1 3
Automatic Telephone	1	8	10	48/-	—	4 3 4
Chili Telephone	5	5	6	7⅜	—	3 18 3
Eastern Extension	10	10	10	17½	—⅜	*5 16 9
Eastern Tel. Ord.	Stock	10	10	170½	—2½	*5 17 4
Globe Tel. and T. Ord.	10	10	10	17⅜	—	*5 13 4
do. do. Pref.	10	6	6	10⅝	—	5 10 4
Great Northern Tel.	10	20	20	37½	—1¼	5 6 8
Indo-European	25	8½	10	43½	—	*5 14 11
Marconi	1	Nil	Nil	27/6	—1/9	... ...
Marconi-Marine	1	7½	8⅜	28/9	—2/6	6 1 9
Oriental Telephone Ord.	1	12	12	51/3	—1/3	*4 13 6
United R. Plate Tel.	5	8	8	10⅜	—¼	*3 15 3
Western Telegraph	10	10	10	17½	—	*5 16 0
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8½	—	7 17 2
do. do. 2nd Pref.	5	6	6	8 7/16	—	8 8 6
do. do. 5% Deb.	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	,,	8	8	500	—	... ...
do. do. 8% Pref. Ord.	,,	6	8	134½	—	6 8 6
Brazil Traction	100	5	6	202	—2	2 19 11
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	93½	—	5 6 11
do. do. Preferred	...	6⅛	6⅛	150	+4½	4 3 4
do. do. Deferred	,,		8	189	+1	*4 4 8
do. do. Deb.	,,	4½	4½	80½	—	5 5 11
London & Sub. Trac. 5% Pref.	1	Nil	Nil	9/6	—	Nil
London United Tram. Deb.	Stock	4	4	58½	—	6 16 9
Mexico Trams, 5% Bonds	—	5	5	76	—	6 11 7
Mexican Light Common	100	Nil	Nil	53	—	Nil
do. Pref.	100	Nil	Nil	72	—	Nil
do. 1st Bonds	—	5	5	79½	+2	6 5 9
Yorkshire (West Riding)	1	5	—	7/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox		13	13	8½	+2/6	4 3 2
British Aluminium Ord.	1	12½	10	45/-	+6d.	4 8 11
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	8 1/32	—	3 16 2
Brush Ord.	1	10	10	28/9	—	6 16 4
Callenders	1	15	15	8⅜	+ 1/16	3 17 5
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Pref. Ord.	1	Nil	Nil	16/-	—	... ...
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	90	—	5 11 1
Electric Construction	1	10	7½	28/9	+1/3	5 4 4
Enfield Cable Pref.	1	7½	7½	25/-	—	6 0 0
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	13/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	7½	34/6	—	4 6 1
Henley	1	20	25	5 5/16	—⅛	4 16 6
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	8	—	12/6	—8/-	*4 0 0
Johnson & Phillips	1	17½	12½	49/3xd	—	5 1 8
Met.-Vickers Ord.	1	8	8	28/9	+1/3	5 11 4
do. Pref.	3	8	8	2⅞	—	6 4 8
Siemens Ord.	1	7	7½	30/-xd	—1/9	5 0 0
Telegraph Construction	12	10	10	20½	—	*4 1 7

* Dividends paid free of Income Tax.

Industrial Conditions in Germany.

The Progress of "Rationalisation."

THE Department of Overseas Trade recently issued a "Report on Economic and Financial Conditions in Germany" covering the period from May, 1926, to June, 1927, by Mr. J. W. F. Thelwall, Commercial Secretary, Berlin, with chapters contributed by Mr. C. J. Kavanagh, Commercial Secretary, Berlin. As is concisely stated at the beginning, this period was one of uninterrupted improvement in every branch of German trade and industry, which was due partly to the natural process of recuperation after the stabilisation of currency, and partly to the labour troubles in Great Britain. In this connection the movement for obtaining a maximum production at a minimum of cost (rationalisation) has made progress and received special stimulus by the example of the United States, which much impressed many Germans who visited America after the stabilisation. For similar reasons standardisation has been energetically taken in hand and applied to a large range of articles, as, for instance, in the precision tool branch, where 80 per cent. of the output now consists of standard parts. The fear that the extension of rationalisation would cause permanent unemployment has proved to be unfounded; in fact, the very opposite is shown by the labour statistics. The process of concentration has continued, and the most noteworthy examples are the linking up of the Steel Trust (Ver. Stahlwerke) with the steel works in Central Germany and in Upper Silesia and the concentration in the shipbuilding, cement, and other industries. Moreover, the same process is proceeding ceaselessly on a smaller scale throughout the country. Although by no means the sole cause, the report submits that this form of rationalisation has contributed very materially to the present satisfactory condition of German industry.

Considering the question of Anglo-German trade, the report states that it might be well if the industries of the two countries took steps to see if they themselves could not bring about a state of affairs which would minimise the harmful competition which at present exists between them. As it is, the fact is recalled that both countries are represented in various international conventions which are proving beneficial as, for instance, the international syndicates for electric lamps, gas mantles, rails and aluminium. In the case of German exports to Great Britain and Northern Ireland, it appears that the value of the electrotechnical products amounted to 24,286,000 marks in 1926, as compared with 26,664,000 marks in 1925, and with 20,769,000 marks to the United Kingdom in 1913. On the other hand the value of the total exports of machines and electrical products from Germany in 1926 is shown in an appendix to have been 307.5 millions of marks, of which 36.3 millions are attributed to the Netherlands, 24.8 millions to Italy, 19.9 millions to Argentina, and 19.7 millions to Sweden.

Dealing with the metallurgical and engineering industries, the report says that in the absence of any acute labour unrest the industrial leaders have been free to devote themselves to the improvement of their productive equipment and their organisation to fit in and harmonise with post-war marketing conditions. The attitude of labour to the introduction and service of labour-saving and speeding-up machinery is one of understanding, and Germany has passed through a phase of industrial adjustment which has largely contributed towards her astonishing recovery. Another cause favouring this development is the protected home market, which lends stability and confidence to enterprise, and promises more definitely a return on fresh capital outlay. Having thus set themselves up on modern lines, the result is claimed to be that German industrial equipment is now of such imposing proportions, so technically excellent, and backed by an industrious and less highly paid labour, that the combination is one which will have a far-reaching influence in the world market.

In this direction the report points out that the past few years have witnessed the erection of complete new steel units, some of them with blast furnaces having a capacity of 1,200 tons per day, and others with new plant for all kinds of rolled products. The output per man-hour has been increased by every modern device, from conveying equipment to process machinery and the electrical drive, while at the same time the country has assimilated the best that American practice can teach in the branches in which it particularly excels. The country has practically made good the steel losses occasioned by the severance of the works in the ceded territories. The application of electric power increased tenfold in the metallurgical industries between 1907 and 1925, and sixfold in the machine construction branch. Everywhere the industrialist has prepared a directive policy in which modern equipment finds a prominent place, and which is strengthened by group associations, amalgamations with former competitors in production, research and marketing, by the formation of cartels or syndicates, and by an active policy of international co-operation to eliminate or mitigate uneconomic rivalry. In the case of the iron and steel industry the syndicates have developed beyond the plane of mere price agreements, and have assumed a directive character which aims at stimulating consumption. A further stage has been the formation of the European Steel Trust (International Steel Ingot Community), comprising makers in Germany, France, Belgium, Luxemburg, the Saar, and Czecho-Slovakia. This trust controls the production in each of the interested countries, and a further development is now being sought by the constitution of sales syndicates for semi-finished steel and rolled products other than those already controlled internationally (rails, tubes, and wire rods). As between Germany and the Saar, an agreement now exists under which steam engines, dynamos, &c., are allowed to be imported from Germany into the Saar at the minimum tariff.

In the chapter dealing with chemical and fuel technology it is mentioned that the most important phase of development lies in the trend of research and the investigations into, among others, synthetic fuel production and the interweaving of chemical processes so that the surplus products from one process may be harnessed to another. Whilst the temperature and pressure requirements for synthetic research on a commercial scale are being closely studied, research is being extended to the sphere of reaction accelerators, such as the electric field and electrical discharge, in the hope of defining more closely the conditions necessary for the "fractionalisation" of hydro-carbons.

The part of the report treating of the electrical industry concerns essentially the supply branch. It appears that the energy produced by the power stations in 1926 amounted to 12.1 milliards of kWh, as compared with 11.7 milliards in 1925. During the second half of 1926 the consumption for industrial purposes rose considerably, the monthly average supplied by 103 works having exceeded that in the first half by 12.2 per cent. Despite this development the consumption per kW installed, calculated on the monthly average during the two years, was lower by 7.9 per cent. in 1926 than in 1925. On the other hand, the increase in kW installed amounted to 4.3 per cent., as compared with 9.4 per cent. in 1925. It is considered evident from the capital expended by the works in 1926 that a much higher demand for power is expected in future. Some of the companies increased their working capital, while others raised loans abroad.

Concerning the dispute between the Prussian State and private enterprise as to areas of supply, it is mentioned that an agreement was entered into in May, 1927, for co-operation between the State and the Rhenish-Westphalian Electricity Company. Besides this the State works are to be centralised in a company and converted into a business concern and removed from official administration. In July, 1926, at a meeting of the Reichs Elektrizitäts-Beirat (an advisory committee on questions of electric power supply) the formation was advocated of an impartial non-fiscal board for dealing with all problems and conflicts arising in this sphere. A subcommittee was appointed, but no further progress has been reported since that time.

One of the most important events of last year was the linking up of the network of the Rhenish-Westphalian Electricity Company and the Rhineland district with the South German water-power region. The 220,000-V line has been designed so that it can later be used for 380,000 V. A second important matter applies to the long-term contract entered into between the Elektrowerke and the Berlin Municipal Electricity Company, on the one hand, and the Reich Railway Company on the other, for the supply of power to the Berlin suburban railways. The Elektrowerke has extended its plant in Central Germany to a capacity exceeding 400,000 kW, and is constructing a fourth line between its works and Berlin, and is also extending its line into Silesia in connection with a contract with the Silesian Electricity Company and the Communal Supply Company of Sagan. In the case of the hydro-electric works it is noted that those in Bavaria developed favourably, the sales of energy having increased by 46 per cent. over 1925. The network of Bavaria, Wurtemberg and Baden will be connected together as soon as the line is completed which is projected between Obertuerkheim and Pforzheim. In addition, the Bavarian network is supplied with power by the Tyrol Water Power Company. Moreover, the State of Baden has acquired a participation in a German-Swiss company which is to erect a power station at Ryburg-Schwoerstadt on the Upper Rhine, with a capacity of 120,000 h.p.

The railway question is only briefly touched upon. During the year it is mentioned that a further electrified length of 110 km. was completed thus bringing the total to 1,050 km., with 286 locomotives and 341 self-propelled units in operation. An additional 40 electric locomotives and 422 self-propelled units are under construction. It is stated that train telephones were introduced on the German railways in January last year. The service was first operated on the Berlin-Hamburg route, and is to be extended to 18 other lines.

The report observes that the number of telephones (main

and subsidiary connections) increased from 2,540,000 in 1925 to 2,640,000 in 19 6; and the number of automatic exchanges was 221, with 143,000 subscribers. The telegraph is said to be increasingly superseded by the telephone so that the telegraph department shows an annual deficit of 40,000,000 marks. Two important cables were laid during the year. One was between Germany and Denmark, and the other between Germany and the Azores. The chief wireless connections are with the United States, Argentina China, Japan, the Dutch East Indies, Brazil, and Egypt. The number of subscribers to the broadcasting system was 1,500,000 on February 1st, 1927, or an increase of 261,000 over April, 1926. At present 22 broadcasting installations are being carried on by ten companies. The transmitting apparatus at Koenigswusterhausen is to be replaced next year by one of five times greater capacity.

In conclusion, we should mention that the report also deals at some length with the labour question.

Electrical Manufacturing in Canada.

Production in 1925 and 1926.

THE production of electrical apparatus and supplies in Canada during 1926 amounted in value to $69,767,308, according to a statement issued by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics, Ottawa. This output was the greatest recorded for the industry, and exceeded by 16 per cent. the previous high record of $60,158,837 established in 1925.

Reports were received from 132 firms in this line of production and, of this total, 98 were situated in Ontario, 19 in Quebec, 6 in Manitoba, 5 in British Columbia, and 4 in Alberta. These concerns employed a total working capital of $80,323,534, gave work each month to an average of 15,246 people, paid $18,626,500 in salaries and wages, and by manufacturing processes added $39,571,373 to the value of purchased materials which cost $30,195,935. The growth of the industry in the past five years is indicated in the following table :—

Year.	No. of plants.	Capital employed. $	No. of employes.	Cost of materials. $	Selling value of products. $	Value added by manufacturing. $
1922 ...	101	62,436,282	10,630	17,546,839	41,208,368	23,661,529
1923 ...	108	65,077,942	13,268	26,257,361	51,360,400	25,103,039
1924 ...	109	72,301,204	13,670	24,370,996	56,490,465	32,119,469
1925 ...	122	75,375,623	14,112	25,434,836	60,158,837	34,724,001
1926 ...	132	80,323,534	15,246	30,195,935	69,767,308	39,571,373

The following tabular statement analyses production and compares values in the two years 1925 and 1926 :—

	1925. Selling value. $	1926. Selling value. $	Inc. or dec. $
Batteries—			
Storage	3,646 405	4,352.433	+ 706.028
Dry	3,186.104	3,291,500	+ 105.396
Parts and supplies ...	53,759	123,493	+ 69,734
Brushes, generator and motor	77,861	126,140	+ 48,279
Conduit and moulding, interior	721,912	1,047,846	+ 325,934
Controllers, rheostats, autostarters &c.	31,774	200,194	+ 168,420
Cooking and heating apparatus—			
Flat irons	341,451	314,690	– 26,761
Stoves and ranges	474,337	619.517	+ 145,180
Water and air heaters ...	296.817	300,200	+ 3,383
Unspecified	253,935	241.893	– 12 012
Fans	51,479	31,525	– 19,954
Fuses and fuse wire ...	252,282	287.284	+ 35,002
Generators, a.c. and d.c. ...	2,758,8 9	3 222 389	+ 463,570
Lamps, incandescent ...	3,277,587	3,979,841	+ 702,264
Lamps, bulbs, bases and other parts	4.250	82.944	+ 78,694
Lighting fixtures	1,224.630	1,312,029	+ 87,399
Lightning arrestors	133,559	180,112	+ 46,553
Line material for light, power, telegraphy, telephony, &c.	586,500	741.163	+ 154.663
Motors—A.c.	2,595,784	4,235,042	+1,639.258
Parts and supplies ...	337 196	160.630	– 176 566
D.c.	297 604	717,194	+ 419,590
Parts and supplies ...	120.008	113,677	– 6,331
Meters, watt-hour, ammeters, voltmeters, &c.	941.843	1 010.249	+ 68.406
Pneumatic tools and parts	1,221,002	1,930,348	+ 709,346
Radio apparatus and supplies	4,337.572	3,899,517	– 438,055
Rectifiers, for storage battery charging	61,013	127,182	+ 66,169
Sockets, rosettes, plugs, cut-outs, &c.	819,298	880,036	+ 60,738
Sparking plugs	672,043	698,732	+ 26,689
Switchboards, light and power	1,895.281	1,729 506	– 165.775
Switches of all kinds ...	1,146,229	1,204 247	+ 58,018
Telephone material, including switchboards, telephones, receivers, transmitters, parts	7,771,933	7,509,859	– 262,074
Transformers—			
Power and service types, 50 kW and over ...	1,694,100	3,628,794	+1,934,694
Power and service types, under 50 kW	1,813.374	1,023.768	– 789 606
All other types	177,363	154 558	– 22,805
Vacuum cleaners	1,543,560	1,345,427	– 198,133
Wires and cables, copper and aluminium	10,963,108	13,791.282	+2,828,154
Wiring material, n.e.s. ...	50 926	269,087	+ 218.161
Apparatus or supplies, n.e.s.	2,037,454	2,702,404	+ 664,950
Repair parts, n.e.s., and repairs	672,790	770.407	+ 97 617
Products of 1 or 2 firms	1,615,875	1,410,219	– 205,656
Total	$60,158,837	$69,767,308	+$9,608,471

Production figures are for the electrical supplies industry only and do not necessarily represent the total output in Canada of the commodities listed; there may be also a small production in other industrial groups.

The Spalding Electricity Undertaking.

The bulk supply of electricity to Spalding, which has recently been inaugurated, is taken from the Peterborough Corporation.

SCHEMES for a supply of electricity in Spalding have been under consideration for a good many years, and the matter was brought to a head in 1921, when the Urban Council refused its consent to a Special Order for electricity proposed to be applied for by a company. In 1922 it was decided to obtain an expert's report and eventually an application was made to the Electricity Commission for a Special Order, authorising the Council to supply electricity in the urban and rural districts of Spalding. The Order was duly made and confirmed by Parliament.

In deference to the wishes of the Electricity Commissioners negotiations were entered into with the Boston and District Electric Supply Company and the Peterborough Corporation for a bulk supply, and in 1926 a contract was signed between the Urban Council and the Corporation for a supply of electricity from the Eye Green sub-station, Peterborough.

As the transmission cable passed through a district which was in neither the Corporation's nor the Urban Council's electricity areas, a further Special Order was applied for. This "Spalding Extension Order" enables the Urban Council to supply any consumers on the route of the transmission cable (outside the Peterborough Electricity area) and for a considerable distance either side of it, including Crowland, where the demand for electricity is most encouraging and a transformer has been fixed on the transmission cable passing through the town. There is no question as to the demand for electricity in the town of Spalding itself, and many consumers have been connected to the mains.

The demand in the rural districts has been somewhat surprising. In addition to Crowland, an urgent demand has arisen at Moulton Chapel, some two miles from the transmission line at Cowbit, where provision has been made for a transformer. The villages from Spalding to Donnington, including the latter, have made urgent requests for supplies.

A further demand has arisen from a point on the transmission cable that happens to be on the border of the Peterborough Corporation's and the Spalding Council's electricity areas. The Peterborough Corporation has no main in the neighbourhood, and it is probable that the two authorities will agree between themselves for the Urban Council to supply these consumers.

At Spalding work on the new sewage system has been commenced and the 100 h.p. or so of motors to be used for pumping will be supplied from the distribution mains in the town.

It has been decided that the new bridge over the River Welland will be electrically operated, and a supply of electricity will be introduced to the sugar-beet factory, probably during the coming winter. It is hoped that as the mains become further extended they will be made use of by the Fen Drainage Authorities for pumping purposes.

The supply to Spalding will depend for a year or so on one underground transmission cable from Eye Green, but it would be fairly safe to prophesy that within three years alternative

supplies would be available in Spalding, either from other sources altogether, or by new routes from Peterborough.

The system has been laid out with special regard to connections for isolated farms or groups of houses, and 11,000 V has been adopted as a transmission pressure, sufficiently high to ensure reasonable transmission costs, and low enough to enable isolated connections to be made.

The general lay-out of the scheme differs considerably from that usually adopted. Instead of a central sub-station at the end of the h.p. transmission main, a system of isolated transformer units has been adopted, one being fixed wherever it is necessary to give a l.p. supply. The main control of the system will therefore be at Eye Green, with one or two intermediate switch points between that place and the far end of the transmission cable. At every point where a transformer is fixed sectionalising apparatus is installed. The electrical system is standard in every respect—a.c., 3-phase, 50 periods. The transformer units are specially designed for standing in the open, and are complete with the necessary switchgear and fuses. Arrangements are incorporated for varying the distribution pressure within a considerable margin. The transformers have been specially designed to enable the pressure of the distributing mains to be raised or lowered within a considerable margin.

The Council has received sanction to loans that will enable it to supply electrical installations and apparatus, including motors on hire or hire-purchase, and this will cause a far greater number of people in the district to make use of electricity than would be the case if every consumer had himself to provide the cost of installation and apparatus.

The original Spalding scheme was laid out on the assumption that all consumers would have to pay for their installation and apparatus, but the recent Electricity Act passed by Parliament confers hire and hire-purchase powers on all local authorities, large and small, whereas up to that date only the larger local authorities had obtained these powers by costly special local Acts. In view of these facilities it is anticipated that the demand will be greater than was estimated in the original report. At the same time the mains and transformers are so arranged that if the demand does increase beyond expectation in any particular district, additional supply can be given at a very small cost. Nothing would require to be scrapped or superseded and it only entails supplementing the mains and transformers that are already installed.

The main contractors were the Pirelli-General Cable Works, Ltd., for the cables, and the Foster Engineering Co., Ltd., for the transformer units. Mr. G. W. Molle, B.Sc., a partner of Messrs. A. Hugh Seabrook & Partners, consulting engineers to the Spalding Council, was chiefly responsible for supervising the work.

Electrical Accidents in Mines.

Report of H.M. Electrical Inspector of Mines for the Year 1926.—*Abstract.*

THE report of H.M. Electrical Inspector of Mines, Mr. J. A. Bernard Horsley, has recently been issued (H.M. Stationery Office, price 4d. net), and the following is a summary of its contents:—

During the year considerable activity was shown in the preparation, or adaptation, of specifications for mining electrical equipment under the auspices of the Colliery Requisites Sectional Committee, and the following summarises the results of the work of the panels dealing with that branch of the subject:—

(*a*) Flame-proof air-break switches for voltages not exceeding 660 (Revision of B.S.S. No. 126); reported to Sub-Committee.

(*b*) Flame-proof air-break circuit-breakers for voltages not exceeding 660 (Revision of B.S.S. No. 127); reported to Sub-Committee.

(*c*) Mining-type transformers for power and lighting (to be B.S.S. No. 171); reported to Sub-Committee.

(*d*) Cable glands and sealing boxes: initial steps taken.

(*e*) Underground lighting fittings; initial steps taken.

(*f*) Mining-type motors and generators; initial steps taken.

(*g*) Flame-proof enclosures, definition and tests; B.S.S. No. 229, published.

(*h*) Flame-proof plugs and sockets for heavy duty; reported to Sectional Committee and since published as B.S.S. No. 279.

The number of mines at work during the year was 2,840, as compared with 2,721 for the previous year. The mines at work using electricity numbered 1,577, a reduction of 12. 768,100 h.p. of motors was install'ed above ground and 852,045 below, representing a total increase of 63,910 h.p.

It is interesting to note that whereas in 1912 62 per cent. of the total h.p. installed was below ground, the proportion has now fallen to 52.6 per cent. There has been a relative increase in the h.p. of motors installed for winding and for miscellaneous services above ground, while all other services are relatively either stationary or recessive.

Electric winding has increased considerably in the Newport and Cardiff area, from 18.41 per cent. for 1925 to 19.42 per cent. of the total h.p. installed, while, on the other hand, electricity is practically excluded from the vicinity of the coal face in that area. Electric pumping, which in Yorkshire is at the lower limit round about 13 per cent., rises to over 35 per cent. in Scotland. Coal face machinery, which accounts for more than 16 per cent. of the total h.p. of motors installed in Scotland, is relatively insignificant elsewhere, except in division 4, Notts, Derby and Leicester, where it accounts for over 10 per cent.

During the year there were four fatal accidents, one life being lost in each instance. Three occurred at collieries, two below ground and one above ground, and one at a clay pit less than 20 feet deep. All four were simple cases of electric shock, and it is pointed ont that three of these ought not to have occurred if reasonable precautions had been taken. There was only one instance of the ignition of firedamp by arcing in a trailing cable. The number of persons killed during the previous year was 8.

Summary of Fatal Accidents Due to Electricity.

Hucknall No. 2 Colliery, Notts.—A coal-cutter chargeman was killed by electric shock received from the frame of the machine. The cutter, which was driven by a three-phase motor at 500 volts, earthed neutral, was at work with the jib trailing and was within three feet of the end of the cut. The haulage prop had just been re-set, when the machine kicked partly out of the cut and the trailing cable, being caught by the picks, was torn in two, leaving one live conductor in contact with the chain jib. The cable was of the usual four-core c.t.s. type, and it was found that one live core and the earthing conductor were together; the other live core was free. One of the three fuses in the gate-end switchbox had blown, presumably because of the short-circuit between one phase and earth in the trailing cable; the other two fuses were intact. It is a reasonable inference that if there had been a circuit-breaker at the gate-end, instead of fuses, all pressure would have been cut off instantaneously when the cable was damaged.

West End Brickworks Quarry, Middlesex.—A quarry labourer received a fatal electric shock from an iron pipe coupled to a small air-compressor which was driven by an electric motor supplied with d.c., 440-480 V. The compressor, motor and switchgear were separately mounted on a timber frame, and at the time of the accident the metal cover of the switch and the compressor were both touching a sheet of corrugated iron that had been placed over the apparatus to keep off rain; the equipment was standing in the open air. The compressor had been erected and set to work nine days before the accident, to give a demonstration with a pneumatic shovel in the clay pit, and the electrical connection had been made with ordinary unenclosed insulated conductors to an adjacent overhead electric line, but no attempt had been made to earth the metal framework of the motor or the enclosing metal case of the switchgear. The circuit was not disconnected when the preliminary demonstration was over because a further trial was proposed, and meantime a small quantity of water collected in the switchbox at one terminal, with the result that the box became alive. Deceased, in passing under the iron air pipe, which was supported on wooden posts about 4 ft. 6 in. above ground level, touched the pipe; he was seen to be holding the pipe with both hands. Another labourer who tried to pull deceased from the pipe was likewise held fast, and became unconscious. The accident was due entirely to neglect of the elementary precaution of earthing the electrical apparatus.

Carnock Colliery, Stirling.—The electrician in charge was alone in the power house during the forenoon and was known to have been preparing the material to connect some lamps between the bus-bars and earth which were designed to serve as a leakage indicator. He was found lying unconscious on the floor near one end of the switchboard. It was evident that deceased had been standing on the ladder fixing a base board when he touched one of the live bus-bars. The system was three-phase at 600 V, 50 cycles; the neutral point was not earthed, but there was such leakage upon the system as to complete the circuit through the man's body. The switchboard was of the panel type with switches and bare conductors and terminals mounted on the back. It is a common defect of switchboards with open-type equipment that there is no provision for piecemeal isolation, so that minor alterations or adjustments, or even cleaning and detail examination, must either be omitted or must wait until a convenient season, which generally means Sunday work.

West Auckland Colliery, Durham.—A pump attendant was killed by electric shock on touching a lampholder suspended

in front of an old refuge hole from which he was emerging. A man near-by found that he had fallen backwards and was grasping the lamp-holder, the lamp being alight. This man attempted to cut off the current at an adjacent switch, which, however, did not control this lamp, and received a shock from the switch cover which knocked him down. He then used his cap to strike the lamp-holder out of deceased's hand. The lamp had been recently installed, and a 12-core rubber-insulated telephone cable with a steel suspending core had been carried through a short length of metal tube into the lamp-holder, for which it was much too large, with the result that one of the live conductors made contact with the brass-work of the holder.

Non-fatal Electrical Accidents and Dangerous Occurrences.

Notices were received of 37 notifiable non-fatal electrical accidents and dangerous occurrences involving injury to 36 persons. One of these occurred at a tin mine in Cornwall, one at a quarry, and the remainder at collieries. Twenty occurred below ground and 17 above ground. Included in these totals there were three accidents classified under the heading of fire underground, and four accidents involving explosions of switchgear. There were no ignitions of firedamp through open sparking. The majority of the accidents were of the ordinary type, and the following two are selected from those which resulted in fire below ground.

Emlyn Colliery, Carmarthen.—Originating in a three-way cable joint box in a haulage motor room situated about 1,600 yards from the pit bottom, the fire spread to the timber supporting the roof. There was no personal injury. While the quality of the equipment generally was good, there were serious defects in the method of jointing and sealing the cables, and the requirements of Regulation 128 were inadequately met. The system was d.c. at 500 volts. The feeder cable was 130 yards long, and consisted of a 2-core 61/12 S.W.G. bitumen-insulated double-wire armoured cable. It terminated at a 5-way control board, where there was a 3-way d.p. iron-cased air-break fuse board, one fuse of which controlled a sub-branch feeder consisting of a 2-core 19/16 S.W.G. bitumen-insulated wire-armoured cable, which continued for 1,000 yards to a 3-way cast-iron cable joint box in the haulage motor room, where the outbreak occurred. From this joint box a short length of similar cable was carried to the control switch for the 45-h.p. haulage motor, while the other leg of the tee was continued down an incline for a further distance of 250 yards to feed a 10-h.p. pump motor. This branch cable consisted of odd lengths of 7/16 and 19/18 S.W.G. connected together in straight-through cast-iron joint boxes. The nearest point at which the pressure could be cut off was 1,000 yards from the scene of the fire. It appears that a derailed tram on the incline pulled the small branch cable partly out of the first cable joint box and a short-circuit between cores started there and destroyed the cable internally right back to the 3-way box, where it joined the larger cable in the haulage motor room. The injury to the small cable was not observed, or was ignored until the 3-way box burst into flame. At this point the iron box and the copper conductors within were fused into a mass. These joint boxes were not sealed with insulating compound, and the joint making was crudely done. No fuses were blown, nor was the circuit-breaker at the pit bottom, or elsewhere, tripped automatically. There were no fuses at the origin of the small branch cable, and the fuses at the origin of the 19/16 S.W.G. cable were too large to afford any useful protection.

On one pole the fuse at this point comprised two copper wires, each .064 in. diameter, while on the other pole there were three such wires. A sustained current of not less than 300 A would probably be required to fuse the smaller of these. The normal full-load current for the two motors together would be approximately 95 A.

The branch feeder to the haulage should have been carried to the bus-bar chamber of a 2-way control panel, and the small branch cable in the incline should have been protected at its origin at this point.

Rotherham Main Colliery.—An underground workman, who had been attending to the batteries of the signal bell circuits, entered a cabin provided for his use near the pit bottom, and hung his working trousers, which were woollen and wet with sal-ammoniac, upon one of two fixed electric lamp brackets to dry. About two hours later the trousers were seen to be smouldering. The lighting unit comprised a 25-c.p., 110-V carbon-filament lamp in a well glass fitting of the usual type. The glass bulb of the lamp itself had melted, and the well glass had cracked and fallen. Rough experiments were made to ascertain the temperature attained by the external surface of the well glass. Using a 25-c.p. carbon lamp with no covering over the well glass, a temperature of 206 deg. F. was obtained after 60 min. A similar test, using a 30-W tungsten lamp, resulted in 130 deg. F. Loosely covering the well glass with dry woollen trousers, using a 25-c.p. carbon lamp, resulted in a temperature of 450 deg. F. after a 100-min. test. With the same lamp and the well glass covered with cloth on fire 581 deg. F. was reached after 125 min. This occurrence may be of interest to those who are considering the preparation of a B.E.S.A. specification for colliery lighting fittings. The well glass had an internal diameter of approximately 3 inches, while the diameter of the lamp bulb, at its widest part, was approximately 2¼ inches.

Working on or near to Live Conductors. Included in the non-fatal accidents were 11 where injury was sustained by 12 electricians, arising from work which was in progress or had been attempted upon or close to live conductors which had not been isolated and earthed, or otherwise made safe, in the manner required by Regulation 131 (*g*). Several of these accidents occurred upon h.p. circuits, and death was missed by a narrow margin.

Electrical Equipment.

Trailing Cables. While the true flexible cable, with a cab-tire or tough rubber sheath, still holds the field, and, indeed, is not likely to be improved upon for use with coal-cutting machines and portable drills; where great flexibility is necessary, there is scope for another type of cable for other classes of coal face machinery, such as conveyors. With such machines, which are not locomotive, but have to be moved forward either daily or at longer intervals, a cable having relatively less flexibility suffices, provided it is sufficiently pliable to allow the surplus to be coiled down, or conveniently stowed out of the way of the traffic. Such pliable cables are actually in use at several collieries, notably at three of the pits owned by the Consett Iron Company, Ltd., in Durham, where nine lengths serving conveyors have been in operation since the end of 1925, and have given complete satisfaction. Internally these cables are exactly like an ordinary trailing cable, but in place of the outer layer of tough rubber there is a sheathing of stranded galvanised-steel wires which serve as the earthing conductor for the apparatus, having the requisite conductivity for that purpose, and also provide a strong barrier of earthed metal between the live cores of the cable and the persons who have to handle it. Outside the stranded armouring there is a braiding of hard cord to check any tendency to bird cageing of the armour. This new type of cable may be aptly described as pliable armoured cable. Plug connectors at each end of the cable are unnecessary. Instead, the cable is made off to cable-dividing boxes, in which it can be properly sealed, and these boxes are bolted to the gate end or other terminal fitting of the permanent cable at one end, and to the machine at the other end. The hazard inseparable from the use of detachable plugs is thus eliminated, without the expense and complication of automatic electrical interlocks between machine and gate-end switch. For equal duty this cable is little larger than a plain c.t.s. cable.

Electric Drill for Shot Holes. A handy and compact rotary electric drill has been tried out at several collieries during the year for putting shot holes into the coal. It is used single-handed, the weight of the machine being 25½ lb. The 3-phase squirrel-cage motor, rated at ¾ h.p., and designed for 125 V, 50 cycles, runs at 2,800 r.p.m., and drives a hollow drill spindle through double spur gearing at 320 r.p.m. The control switch is fitted in one of the two lug handles and a small 4-core c.t.s. flexible cable and connector, which carries the current to the drill from a transformer rated at 1 kW, 600/125 V, 3-phase, allows the operator freedom of movement. In actual trial at Cannock Chase, holes to a depth of 4 feet, which necessitated a change of drills halfway, were put into a strong measure at the rate of 2 feet per minute. The machine is designed to be flame-proof.

Coal-Cutting Machines. From a general analysis for the country as a whole for the last ten years it is seen that the number of electrically driven machines appears to be becoming stabilised round about 7/10ths of the total number of machines of the disk, bar and chain types. It is also evident that machines of the chain type are steadily displacing those of the disk and bar types, for they now represent 60 per cent. of the total number, excluding percussive drills, whereas in 1917 they represented 28 per cent. of that total. Percussive air drills are barely holding their own, for although they have increased 70 per cent. in number since 1917, they now represent substantially the same proportion, *viz.*, 33 per cent. of all machines in use, that they did at the beginning of the decade. It is interesting to note that out of a total of 3,114 electrical machines installed in all areas, 1,446, or 46½ per cent., are in use in Scotland.

Metalliferous Mines and Quarries.

The total h.p. of electric motors installed in these mines at the end of the year was 24,447, against 22,802 for the previous year. The insignificance of these figures in comparison with those recorded for collieries should not be taken as a measure of the utility of electricity to the metalliferous mines, for in many areas, notably in the slate mines of North Wales, electrical power, derived from the water that is so abundant in that region, has been relied upon almost exclusively for a number of years, not only in the mines, but also for the ancillary processes of preparing the slate for sale.

While their electrical equipment is often of an antiquated type, the slate mines enjoy a happy, not to say a remarkable, immunity from electrical accidents. There was only one recorded accident during the year, which was not serious in the result, at a tin mine in Cornwall.

No statistics are available to show the use of electricity in quarries, but in the aggregate the total horse-power of electric motors in use in quarries is undoubtedly considerable. There was one fatal electric shock accident, already described. While at some of the quarries which have been opened quite recently the installations are equal to the best colliery practice, using wire-armoured cables, centralised earthing and metal-clad switchgear of substantial design, in many others the equipment only just complies with the Regulations.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Electrically Driven Air Compressor.

The air-compressor set shown in fig. 1 has been designed and introduced by Messrs. REAVELL & CO., LTD., Ranelagh Works, Ipswich, for charging the starting air bottles of internal-combustion engines, although, of course, there are numerous other purposes for which it may be used. It is suitable for pressures up to 350 lb. per sq. in. and has a piston displacement of 5.2 cu. ft. per min. at a speed of 750 r.p.m. It will, it is claimed, charge a receiver of 2¼ cu. ft. capacity from 200 to 350 lb. in under ten minutes. A distinctive feature of the apparatus is the provision which has been made for cooling the air cylinder, consisting of a cast-iron hopper, open at the top, which contains the cooling water. In this way the air

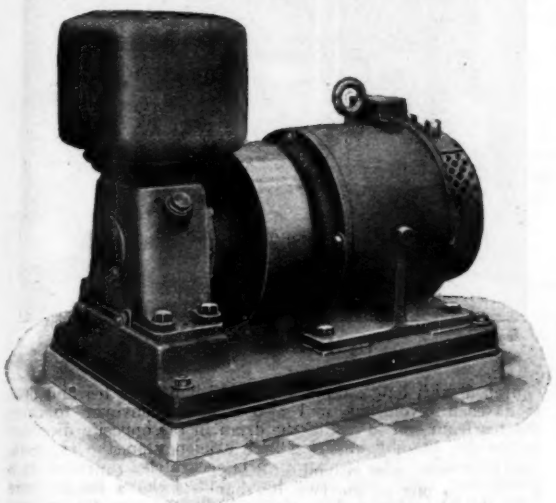


Fig. 1.—Reavell Compressor Set.

cylinder and valves are completely immersed and a most efficient and convenient means of cooling provided. It is of simple and robust construction and works on the single-cylinder single-acting principle, so that on the suction stroke no work is done and the cylinder walls give up heat to the jacket water. The suction and delivery valves are of the poppet type and are easily accessible. They are of nickel steel and extremely light in construction. The lift is reduced to a minimum, thus ensuring freedom from undue wear and silence in working. The driving motor is of 1½ h.p., 750 r.p.m., and can be supplied for d.c. at any voltage between 100 and 400, or for a.c. for either two or three-phase. The complete set is mounted on a cast-iron combination bedplate.

New Cable-Drum Trucks.

The awkward character of heavy drums of electric cable has resulted in the introduction of several special types of vehicle, which, by reason of their low-loading line facilitate the operations of loading and unloading. One of the latest productions of the kind is the "Feast" cable-drum manipulator, made by its patentees, Messrs. SOUTHEND-ON-SEA AUTOMOBILES, LTD., 461-465, London Road, Southend-on-Sea. The vehicle consists of a low-bodied trailer, designed to be drawn by an industrial tractor, built up of channel-iron with a heavy forged-steel cranked-axle as an integral part of the main frame, this being designed to carry the full weight of the cable drum. The method of operation is to position the trailer against the drum to be drawn on to it, attach chains to the spindle through the centre, and, by means of a winch carried on the trailer frame at its front end, draw it up the slightly inclined floor to the correct position above the axle. It is claimed that the work can readily be done by two men, whereas under the old system it was often necessary to employ a group of men in charge of an experienced operator. The drum is under complete control throughout, and, moreover, is only raised 12 in. from the ground level when secured in position on the trailer. The drum is mounted on a special rotor arm, and can be lifted bodily by the winch off the trailer floor, it being then possible to proceed with the laying of the cable without unloading the drum from the trailer.

Another motor truck specially designed for the transport of cable drums is that which has lately been brought out by Messrs. SHELVOKE & DREWRY, LTD., Letchworth, Herts. The vehicle is an adaptation of the "S.D. Freighter," notable for its extremely low-loading platform and the use of road wheels of a diameter of only 20 in. The chassis has a total capacity of four tons and, it is claimed, will transport a total load of this weight at a speed of 10 m.p.h. over ordinary roads. The rear end of the frame slopes downwards slightly, so that the hinged tailboard, which, when down, forms the ramp, is not so unwieldly as usual. A pair of winches are provided at the front end of the lorry platform for hauling the drum into position, as well as special chocks which securely hold the drum in place. Twin wheels are used at the rear in order to assist in withstanding the heavy weight. The vehicle, in addition to cable-drums, is also well adapted for the transport of transformers and other electrical plant.

New Electric Sirens.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has recently placed on the market a range of electric sirens which are particularly suitable, it is claimed, as fog signals, fire alarms and time signals, and for use in docks, ships, warehouses, quarries and mines. Each siren is a complete unit in itself and can be easily controlled, the cost of working and upkeep showing considerable economy over the charges incurred in operating compressed-air or steam-whistle apparatus. In construction, the motor and siren are totally enclosed by an outer case, forming a complete unit which is both strong and compact. The metal parts are of massive construction and the whole is weather-proof and water-tight. Although definite ratings are given to the motors, the latter are very flexible and are fitted with ball bearings and automatic lubrication. They therefore require little attention. The method of construction ensures that the greatest volume of sound is distributed in all directions and the siren is equally effective when mounted in an upright, horizontal, or inverted position. Three types of siren are available, having sound ranges of ¼, ½, and 1 mile respectively. Types 0.5000 and 0.5001 are fitted with universal motors, and made in models suitable for 100-110 and 200-250 V (40 to 60 cycles if for a.c.). Type 0.5002 is obtainable in two models for d.c. or a.c. (40 to 60 cycles), the highest permissible voltage being 250. Switching is effected in all these types by means of a push-button type of switch connected directly in the circuit.

A Quick-break Shockproof Switch.

A new product of the METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is the quick-break shock-proof switch illustrated in fig. 2. It is claimed to be a well-made and efficient article, all the working parts being of heavy-gauge metal, made with precision, thus ensuring continuity of operation. It is constructed with link mechanism,

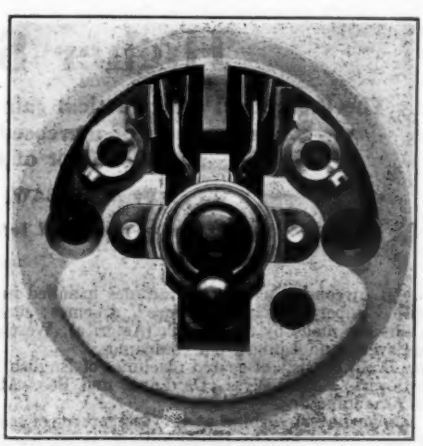


Fig. 2.—M.V. Shockproof Switch.

double-leaf contacts of hard copper, definitely secured in position by peg-plates, and heavy terminals screwed (not riveted) to the contact plates. The movement has a positive action, and is smooth and silent. The vitreous-porcelain bases are made in Messrs. M.-V.'s own pottery. The dolly is of "erinoid" securely pressed on to a brass peg, thus eliminating the possibility of breaking away. The switch can be supplied in a complete range comprising s.p., semi-recessed, 2-way and ordinary semi-recessed, on either white or brown porcelain bases. A switch tested for 20,000 operations showed no signs of wear or fracture of the dolly or base.

A Small Repulsion-Induction Motor.

Within the past few years there have been signs of a considerable increase in the demand for very small electric motors, and the problem of providing these, which are often run off the lighting circuit, has become quite specialised. The ordinary split-phase a.c. motor has several disadvantages when used on a lighting circuit, notably the heavy rush of current at starting, and the possibility of burn-outs on the starter windings. A special switch is also necessary, so that the motor is unsuitable for automatic starting. The NORMAND ELECTRICAL CO., LTD., 3, North Side, Clapham Common, S.W.4, has now produced a repulsion-start induction-running type of motor, which, it is claimed, overcomes these difficulties. This new Neco motor is made in two sizes, ¼ and ½ h.p., 1,400 r.p.m., and has the advantages of a low starting current, very high starting

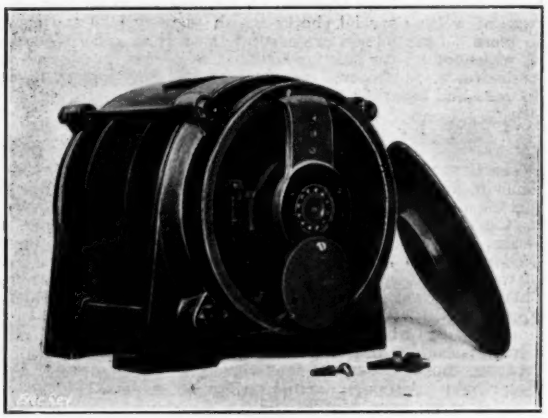


Fig. 3.—Repulsion-Induction Motor.

torque, practically constant speed between no load and full load, and the suitability of starting up from an ordinary tumbler switch. This means that the motor is particularly suitable for pump duties, when a cistern is required to be kept filled to a certain level and the motor is operated by float switchgear, and also for automatic electric refrigerators, air compressors, conveyors, and so on. Fig. 3 is a view of the motor with the cover plate removed and brush gear exposed; the cover plate is secured in position by two small bolts, and it will be seen how very accessible the parts are. The shaft runs in ball bearings, which can be lubricated with vaseline or light grease once a year by swinging down the small cover plate as shown in the illustration. Preparations for manufacturing this motor are well in hand, and deliveries are expected to commence soon. The motor is claimed to be competitive, even with foreign-made machines, and is interchangeable with the makers' ½-h.p., 400-V, a.c. and d.c. machine.

An Electric Tea Drier.

An interesting development of Messrs. DRAKE & GORHAM, LTD., 36, Grosvenor Gardens, London, S.W.1, is an electric tea drier, an experimental machine which has been shipped to Ceylon for practical trials. It consists essentially of an insulated metal container, with outside dimensions of approximately 8 ft. by 4 ft. square, containing baffles and heating elements to provide the circulation of hot air through a rotating cylinder in which the actual drying operation is carried out. The cylinder is

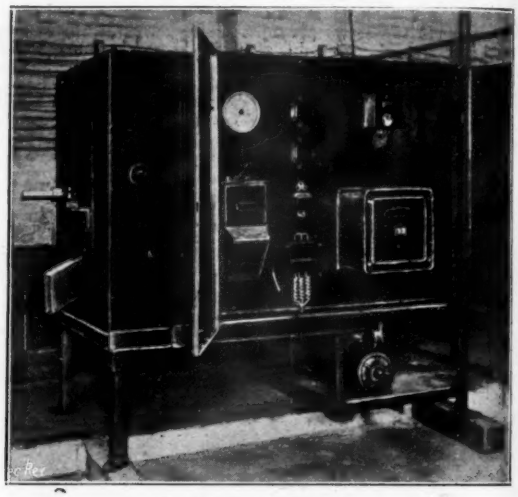


Fig. 4.—Electric Tea Drier.

equipped with longitudinal vanes which lift the tea and drop it at each revolution, and also a screw conveyor to carry the tea from end to end of the drum in the opposite direction to the air, thereby ensuring high efficiency on the regenerative principle. The temperature is accurately controlled by a thermostat, relay, and contactors. Fig. 4 shows the machine from the switchboard side. Accurate figures have not yet been obtained as to the output under operating conditions, but it is anticipated that the cost of firing will be somewhat lower than it is with the present methods. The design of the apparatus may be considerably modified before it is finally put on the market.

Higher Steam Pressures.

The theoretical and practical gains which may be expected from the application to steam turbines of increased pressure over as wide a range as possible, and the effect of high pressure on details of design.

By A. H. LAW, M.I.E.E., and J. P. CHITTENDEN.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page* 840.)

Group B (i) consists chiefly of turbines installed in connection with "superposed high-pressure" schemes; such direct-driven sets are made by the G.E.C. (America), Westinghouse, Brown-Boveri, and Ljungström companies.

Group B (ii) consists of geared machines of English Electric, Brown-Boveri, Escher-Wyss, De Laval and Soc. Alsacienne (Belfort) manufacture.

The Brown-Boveri turbine at the Langerbrugge station, by the employment of two overhung wheels, avoids the use of a high-pressure gland, and also an ingenious method has been adopted for cooling the shaft and preventing steam from blowing into the pedestals, by supplying the gland on the exhaust side with water under pressure. It also may be noted that between the cylinders and the valve gear a number of small-bore flexible pipes are arranged in parallel, thus carrying still further the arrangement adopted for the Parsons machine at Crawford Avenue. A turbine constructed by Messrs. Escher, Wyss for the works of Messrs. Siemens-Schuckert at Siemensstadt, has a casing made in one piece from a solid steel forging, and owing to the coned steam path it is possible to drop the whole rotor together with the diaphragms into the casing in one operation; the exhaust end of the casing, including the exhaust pipe, is afterwards bolted on to the main body.

The latest plant of this type to be under construction is one for the Valley Road power station of the Bradford Corporation; when completed it will be the first example of the "superposed high-pressure" system in this country. The turbine is designed for steam inlet conditions of 1,100 lb. per sq. in. at 800 deg. F. It will run at 6,000 r.p.m. and will drive a 2,500-kW alternator through reduction gearing (fig. 3). The steam will expand in nine simple impulse stages of small diameter. The rotor is machined from a solid forging and the method of blade fixing is a modified form of the De Laval fixing. The diaphragms are all of a "built-up" type milled from the solid, as by this means accuracy of manufacture, a better finish and an improved path for the steam are obtained. The U-pipe method of connecting the steam chest to the turbine has also been adopted in this instance.

Turbine Design.

A larger number of stages implies small diameters, which in turn enable the machine to be designed with greater nozzle and blade heights; this is of particular importance at the high-pressure end, and to a large extent counteracts the effect of the increased density of the steam at the higher pressures. A very considerable decrease in stage mean diameter is necessary if reasonable nozzle and blade heights are to be obtained at the higher pressures; this is important, since the influence

of nozzle and blade height on stage efficiency is very considerable. American tests indicate that there is a falling off in efficiency from 97.5 to 89 per cent. as the height decreases from 100 mm. (4 in. approx. to 5 mm. (0.2 in. approx.). Whilst care in the design and finish of the nozzles will minimise this falling off to a certain degree, the shorter nozzles and blades are undoubtedly less efficient at both normal and higher pressures.

Smaller diameters have also led to the introduction of a rotor machined from the solid, which results in a reduction of weight and overall length, affords more rigid construction and the maximum disk stress is less than in the case of disks mounted separately on the shaft.

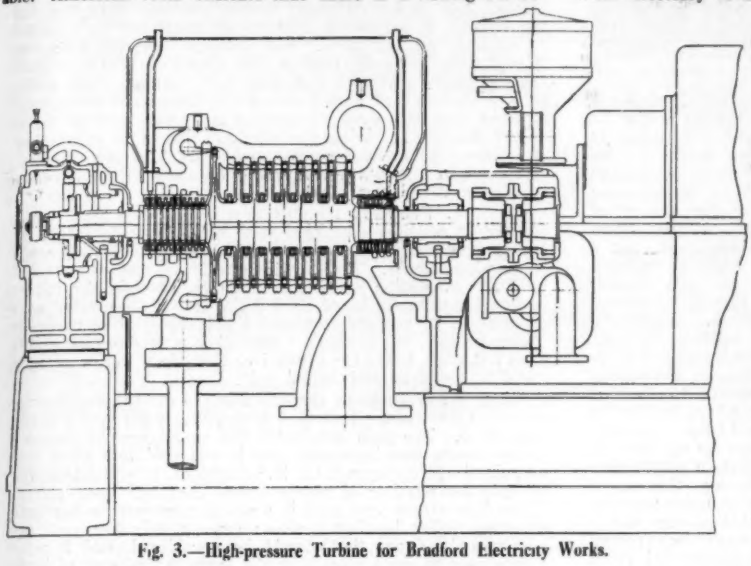


Fig. 3.—High-pressure Turbine for Bradford Electricity Works.

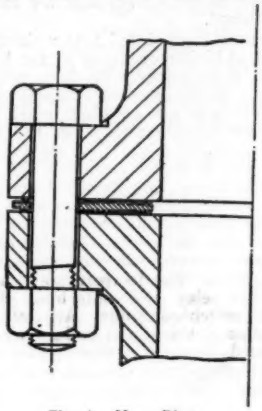


Fig. 4.—Navy Ring.

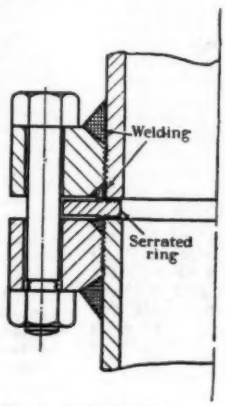


Fig. 5.—Babcock Joint.

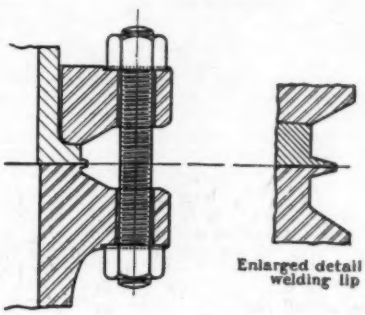


Fig. 6.—Sargol Joint.

Successful Types of High-pressure Steam Pipe Joints.

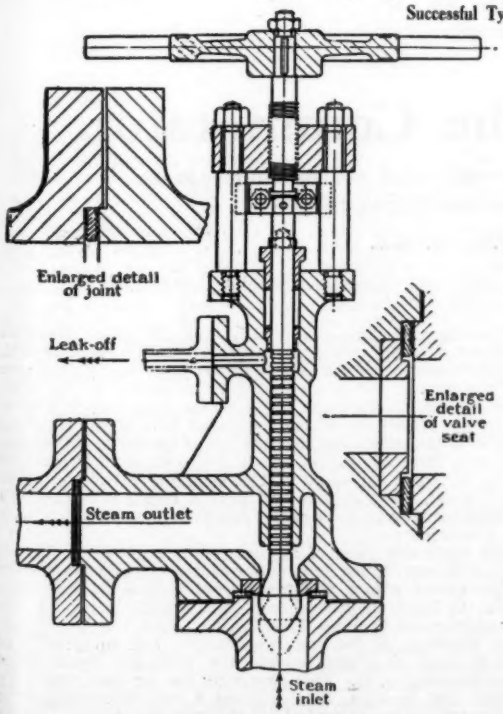


Fig. 7.—Benson Turbine Stop Valve.

With regard to the method of blade attachment, it has not been necessary to depart to any great extent from standard practice; various types of "built-up" diaphragms have been used and a type similar to that employed on an "English Electric" back-pressure turbine is in general use on high-efficiency machines working at both high and more normal pressures; it consists of separate nozzle blocks, each cut from the solid and held in position on a mild-steel centre. With this construction greater accuracy of manufacture and a better finish of the nozzle blade surfaces are possible; it is also possible to pay greater attention to the shape of the steam passage so as to eliminate any losses due to shock and turbulence.

The combination of high pressure and temperature necessitates a particularly strong casing and the tendency is to try to avoid high-pressure joints whenever possible; 1,200-lb. per sq. in. turbine casings are made in two halves rigidly bolted together, each half being a separate casting, the inlet and exhaust steam pipes being also cast integral with the bottom half of the casing; the horizontal joint only is subject to the highest pressures.

In another case the casing has been made from solid rectangular blocks of steel bored and machined to the necessary shape. In some instances the only joint is a vertical one at the exhaust end; the casing, with the exception of the exhaust pipes, is forged from a single piece of steel and the diaphragms are held in an inner casing consisting of two steel castings, the whole being then enclosed in the outer casing of forged steel.

To facilitate the tightening and slackening of the bolts used on high-pressure joints, an ingenious method has been adopted both in the United States and in this country; it consists of drilling a small hole up the centre of the bolt and then expanding the bolt either by an electric heater coil or the flame from a blowpipe when it is desired to make or break the joint. Several designs of pipe joints are in successful use. The first consists of a thin sheet of mild steel with concentric grooves machined on each face, but it has not been used much above 450 lb. per sq. in. (fig. 4). For the higher pressures a modification of this joint, details of which are shown in fig. 5, has been used with considerable success. A third type is shown in fig. 6, and a fourth type of joint, particulars of which are given in connection with the valve illustrated in fig. 7, was developed by the English Electric Co. and used for pressures up to 3,250 lb. per sq. in. with complete success. The packing consists of a labyrinth in series with metallic packing, with a leak-off pipe between the two; while the metallic packing works efficiently, a valve keeps the leak-off closed, but in the event of its failing the valve will be opened and, while the leakage of high-pressure steam is restricted by the labyrinth, the metallic packing can be replaced. One difficulty is the cutting of the valve and seats when throttling takes place; to overcome this, the throttling is done on that portion which does not form the actual place of sealing. The problem of a very efficient h.p. gland, in the authors' opinion, has yet to be solved.

Reliability.

In the report of the National Electric Light Association of America issued in July, 1927, there is a statement to the effect that the general percentage of "outage" due to troubles on the high-pressure turbines during 1925 was 14.75 per cent., as compared with about 7.3 per cent. on more normal-pressure machines for the same period. Taking into account the fact that included in this percentage are machines which are

purely experimental, it does not appear that the percentage is a high one.

Not very much information has been available on the running of Continental machines, but they seem to have given excellent results and have shown a high degree of reliability.

Discussion in London.

Mr. T. ROLES opened the debate by remarking that the opinions of mechanical engineers on the subject would be valued; for years they had been flirting with h.p. steam at Bradford, and several forecasts that were made by his assistant in a paper in 1918 had been justified by subsequent events. The h.p. boilers for Bradford would be of the same appearance externally as the normal type; the quality of the feed water for such boilers was important. Higher superheat than at present used would soon be employed, and a boiler efficiency of from 85 to 86 per cent. would be realised, whilst a turbine efficiency of 86 per cent. was now quoted. Better efficiency was obtainable at steam pressures between 200 and 600 lb. than between 600 and 1,200 lb. Whilst the authors had not considered cost, it would have to be gone into on the electrical side because, unless some gain was in sight, such h.p. plant would not be purchased; the curves in the paper indicated what might be expected. In America 600 lb. was considered the best pressure for a high-load-factor station, but low-load factor plant could use higher pressures. Steam reheating did not seem to have been so satisfactory as expected, but it was necessary, and the system would have to be investigated; perhaps other methods, say, the use of live steam or oil for reheating, would make it more popular.

Mr. E. E. R. WILKINSON pointed out that as the initial pressure was increased, some improvement was to be expected from reheating, but for 250 lb. the most economical point at which to reheat would not be 60 lb. absolute; that figure was too high. The saving in capital cost that would result from the adoption of reheating at some pressures would be greater than at others. The last Electricity (Supply) Act would help turbine designers by calling for larger machines; it had altered the factors that governed the choice of the most economical size of set. In future the 20,000-kW, 3,000-r.p.m. set would be the best from the price and efficiency points of view; above that size a speed of 1,500 r.p.m. would be advisable, and 50 000 kW probably the smallest size to install in interconnected stations. Accordingly blade height would not be so formidable a problem, but a double exhaust would be needed because an alternator stator could not be cast in one piece above that size; above 50,000 kW the machine should perhaps be of the compound design and, say, 150,000 kW in size. The Act gave designers an opportunity to radically change their design considerations. The use of h.p. steam was beyond the experimental stage, and its adoption was now a question of cost: with a load factor of 70 per cent., 50,000-kW generating sets, and coal costing 15s. per ton delivered, a good case could be made out for the employment of 600-lb. steam pressure.

Mr. W. M. SELVEY said that he had long urged the presentation of a paper of that kind. In 1918 he came to the conclusion that steam reheating would not lead very far, but the history of the North Tees station must not be regarded as settling the argument. The subject was still open for, if coal were properly treated, the availability of low-grade gas for direct heating might alter the situation. The ability to produce steam of high pressure and temperature was more forward than the ability to control it by the types of valves as now designed. The gain in efficiency due to the elimination of moisture from steam was not so great as might be expected; material which would not be eroded by water at the velocities now encountered was much needed.

Mr. I. V. ROBINSON thought that the authors had rightly omitted to consider cost; practical details were wanted, for it was experience of operation which would ultimately make or mar h.p. steam. The Dutch State Mines Department had built a h.p. station which was not mentioned in the paper; it would eventually be of 100,000-kW capacity, operated at a pressure of 36 atmospheres, and the turbines were made by Messrs. Stork, of Holland. Special h.p. steam-pipe joints were not used, being too expensive; the joints were a scraped metal to metal fit and bolted only.

Mr. J. W. J. TOWNLEY thought that the outstanding feature of the paper was the fact that it recorded what had actually been done. The gain obtainable fell rapidly as the pressure of the steam was increased, and it was said that there was no point in going beyond 600 lb.; therefore, it was interesting to note the number of repeat orders that had been placed. When h.p. steam was used it was not necessary to purchase so much boiler heating surface; consequently the cost per kW was the figure that should be considered, and it went a long way towards off-setting the extra capital cost of high-pressure plant.

Mr. ALBERT PAGE stated that makers were prepared to offer machines of higher efficiency at the lower pressures than was indicated in the paper. He drew attention to the possibility of making diaphragms of a special cast-iron that could be turned and was non-growing, which might be better than the more expensive steel. On the Continent the tendency was to return from twin- to single-case machines when the exhaust was properly designed; the single-case machine required less space, and twin condensers (which enabled one of them to be cleaned in emergency without shutting down the plant) were a great consideration. One Continental firm alone had supplied over 120 boilers to operate at 600 lb. and over, which showed what had been done.

Mr. J. P. CHITTENDEN, in briefly replying to the discussion, agreed that clean feed water was essential for h.p. boilers, especially when the tubes were so small as in the Benson boiler. So far as all tests he knew of indicated, the efficiency of boilers operating at the highest pressures was identical with that of the lower pressure ones. Satisfactory h.p. steam-pipe joints could be made without the expense of welding.

The Slip-Ring and the Commutator.

Induction motor power-factor improvement and speed control, and apparatus of possible utility for system interconnection schemes.

By Prof. F. J. TEAGO, D.Sc., M.I.E.E.

(Abstract of Chairman's Inaugural Address at the MERSEY AND NORTH WALES (LIVERPOOL) CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE modern electric induction motor is a truly wonderful machine, but it possesses two defects, *i.e.*, a rather low power factor and a small natural range of speed variation. Consider an armature fitted with a commutator having three brushes equally spaced round its periphery (fig. 1). Since the winding on the armature forms a closed circuit, if 3-phase current be fed to one brush it will flow out *via* the other two and, since each brush is fed in turn, a rotating magnetic field will be produced. If the armature is of the two-pole type and the current has a frequency of 50 cycles per second, then either brush is fed by an ingoing current at time intervals 1/50 second apart, which means that the magnetic field makes one complete revolution in 1/50 second; that is, 50 r.p.s., or 3,000 r.p.m. Now it is most important to notice that the speed at which the field rotates in space is quite unaffected by a rotation of the armature, because, although the space positions of the individual conductors forming the coil between a pair of brushes are changed if the armature is rotated, the position of the coil itself does not change, and therefore the speed of the rotating field is independent of any rotation of the armature. It is, however, equally important to notice that the impedance offered by the armature coils to the flow of current through them is a function of the speed at which the armature rotates. The reason for this is as follows:—

When the armature is stationary each individual conductor is subjected to the action of a changing flux, a rotating field, and therefore each conductor possesses both ohmic resistance and inductance; but if the armature is rotated in the same direction and at the same speed as the flux, then individual conductors always lie in one particular part of the magnetic field, with the result that they are not subjected to a changing flux, and therefore the armature possesses ohmic resistance only. If, now, the speed of the armature be raised above synchronism, the windings will possess ohmic resistance and negative inductance, or capacity, and the armature will behave like a condenser.

This particular piece of apparatus was one of the first to be used to correct the low power factor of induction motors having wound rotors, and the general method of employing it was to have an independent and variable drive for the commutator, to feed its three brushes from the three-phase rotor windings of the induction motor, and to drive it at such a speed as would provide the necessary power-factor improvement (fig. 2). This apparatus did not come into very general use, because, besides being a trifle cumbersome, it did not provide speed control for the induction motor. In the case of an induction motor with a wound secondary, if an external p.d. is applied to the secondary winding, then the speed of the motor *may* be such that the e.m.f. generated

internally in the secondary winding is almost exactly equal to the applied p.d., provided that the frequency of the applied p.d. is at every instant equal to the frequency of the generated e.m.f. I use the word "may" because the commutator just described applies a p.d. whose frequency is always equal to that of the generated e.m.f., and yet it does not provide stable speed control, its weakness being due to the fact that the magnitude of the applied p.d. is due to, and is a function of, the motor speed.

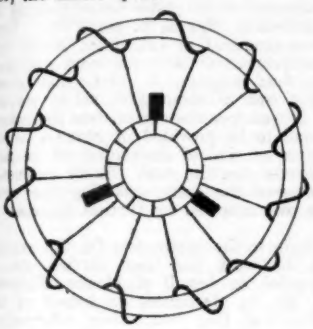


Fig. 1.

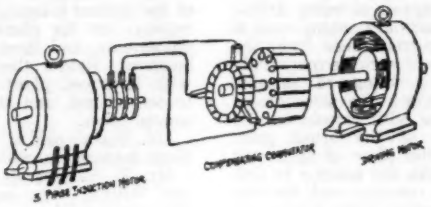


Fig. 2.

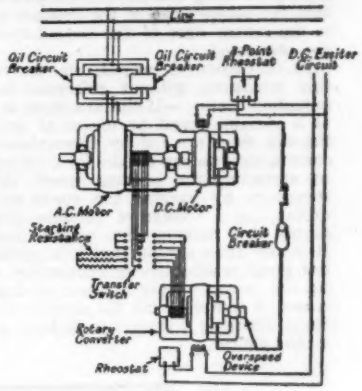


Fig. 3.

The particular combination of slip ring and commutator to which I wish to draw your attention is shown by fig. 3. In the system depicted the induction-motor rotor feeds the slip rings of a rotary convertor and the power factor of the motor is controlled by varying the excitation of the rotary convertor, whilst the speed of the motor depends upon the magnitude of the convertor back e.m.f., so that if the latter is large the motor speed will be low. Now, the back e.m.f. on the slip rings can be varied by varying the p.d. applied to the commutator, which is accomplished in this particular system by varying the excitation of the auxiliary machine coupled to the induction motor. Thus the required condition of equal frequencies for the induced and injected e.m.f.'s on the rotor is fulfilled, since the rotary convertor is synchronous with the rotor and the magnitude of the injected e.m.f. is independent of the speed of the rotor; but it should be observed that the speed of the induction motor must not approach too near synchronism, otherwise the rotary will fall out of step. The auxiliary machine has the advantage of converting the slip energy into useful work, but the apparatus, as a whole, is complicated, costly, and speed control is only possible below synchronism.

Many more attempts to solve the problem of power factor and speed control have been made, but I propose to describe a very recent piece of apparatus which has accomplished the feat besides showing promise of great usefulness in other directions. Consider that this armature carries two quite distinct windings located in the same slots, as shown in fig. 4; the first is a three-phase winding connected to three slip rings whilst the second is a drum winding tapped out to a commutator. If three-phase current is fed to the three slip rings a rotating magnetic field will be produced with rather special properties. Suppose the armature to be stationary and the magnetic field to be rotating clockwise, so that the magnetic field passes the armature slots at some definite speed; if, now, the armature is rotated in an anti clockwise direction, then at some particular speed the field will come to rest in space, because the coils producing the field are being rotated backward at exactly the same speed as the field is moving forward. However, the speed at which the field passes the armature slots is unaltered, because, although the magnetic field is now stationary in space, the slots are moving past the field exactly as fast as the field was originally moving past the slots: this achieves one of our requirements, namely, an e.m.f. can be obtained from the commutator the magnitude of which is independent of the armature speed. However, from the commutator we require e.m.f.'s having a three-phase time sequence if we are to control a three-phase induction motor; moreover, we require to be able to vary the magnitude of these e.m.f.'s. Fig. 5 explains how this is done with a two-pole machine having three sets of double brushes mounted on rockers which enable the distance between the two portions of each double brush to be varied. Now consider that this piece of apparatus is mounted in a stator carrying a three-phase winding, consisting of three separate phases, connected to the brush gear as shown in fig. 6. The only remaining condition to be fulfilled is that the frequency of the e.m.f. injected from the commutator shall be equal to the frequency of the induced e.m.f. in the stator windings, which is achieved it will be readily appreciated when it is remembered that the frequency of the injected e.m.f. depends on the speed of the field relative to the brush gear (just as it does in an ordinary d.c. machine) and that the frequency of the induced e.m.f. depends upon the speed of the field relative to the stator windings. Now both the brush gear and the stator windings are stationary in space, and the speed of the field relative to one is the same as it is relative to the other; if, therefore, when the parts are assembled as described, a three-phase supply is fed to the rotor slip rings, the machine will run at a speed which depends upon the magnitude of the separation of the brush portions; also if the speed is below synchronism with the brush gear as shown in fig. 6, then it will rise to synchronism when the brush portions come together, and rise above synchronism when the brush portions are separated in the reverse

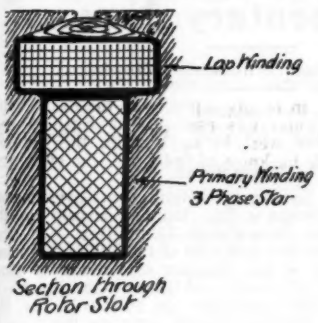


Fig. 4.

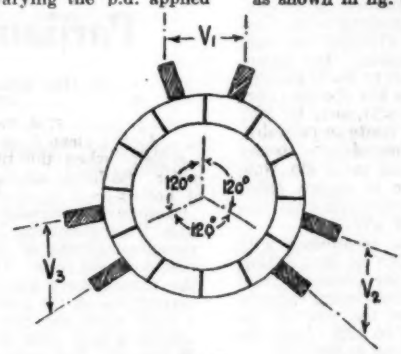


Fig. 5.

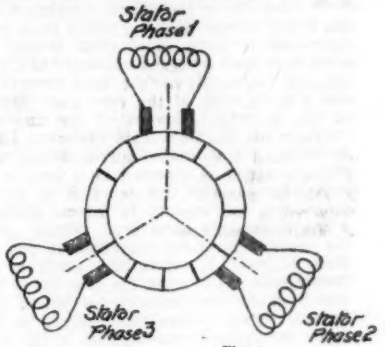


Fig. 6.

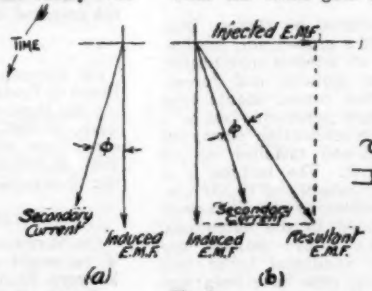


Fig. 7.

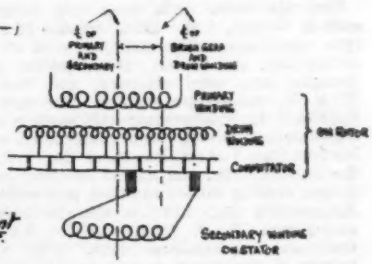


Fig. 8.

direction to that shown. Now the power factor of an induction motor depends upon the phase of the secondary current, which depends upon the phase of the secondary e.m.f., and it is by controlling the latter that the improvement is brought about. It will be seen from fig. 7 that, provided we can control the phase of the injected e.m.f., we can control the phase of the secondary e.m.f. very easily; that the phase of the injected e.m.f. is under perfect control will be readily appreciated from fig. 8, all that is necessary being brush gear capable of being moved bodily round the commutator in order that the centre lines of the brushes may be moved relatively to the centre lines of the secondary windings to which they are connected.

In conclusion, I recapitulate the three chief properties of this armature, without reference to its application to the induction motor:—If the armature is capable of being driven at a variable speed by means of an auxiliary motor, and if the slip rings are fed by three-phase current, then from the commutator we can obtain (*a*) a voltage of variable magnitude by spreading the brushes apart, (*b*) a voltage of variable frequency by varying the speed at which the armature is driven, (*c*) a voltage of variable phase with respect to the supply by moving the centre lines of the brush gear. It would thus appear that this particular piece of apparatus has great possibilities in connection with the scheme to link up the power supply stations of this country, and for this reason it is well worth the serious attention of the profession. Some desirable features are lacking, but that will be rectified in due course.

Electrical Development at Stoke-on-Trent.

Extensions at the Central Generating Station, Hanley.

AN important step in the development of electricity supply in the city of Stoke-on-Trent was marked on November 7th by the official opening of extensions to the Central Power House, Hanley, which have cost £160,000 and been completed in little more than twelve months. The extensions have been rendered necessary as a result of the increasing demand for supply in the area covered by the Corporation, and also in view of the part that Stoke-on-Trent is to take in the national schemes of the Central Electricity Board. Further, the Michelin Tyre Company is establishing a factory at Stoke, the estimated cost of which is said to be a million pounds, which is expected in a year or two to employ about 10,000 hands, and the demand on the undertaking in this connection will amount to several thousand kW.

The extensions have been carried out in accordance with the recommendations contained in the report of Mr. Arthur Ellis, M.Inst.C.E., consulting engineer to the Stoke-on-Trent Corporation, who, when the question of the maximum capacity which could economically be placed upon the site of the Central Power House was referred to him in 1925, fixed the figure for the ultimate capacity of the plant at 46,000 kW.

The new buildings have been designed by the city surveyor, Mr. A. Burton, M.Inst.C.E., and have been erected by a local firm of builders, Messrs. C. Cornes & Son, and include an extension of the present engine room, switchgear annexe and circulating pump-room, together with a short extension of the existing boiler house and also a complete new boiler house. They have been designed to accommodate, in addition to the present plant extensions, a 12,500-kW turbo-alternator set and two further 60,000-lb. boilers to be put in in the future. The total length of the engine room is now 320 ft. and the height from the basement to the apex of the roof 62 ft.

Two new boiler units have been installed by Messrs. Babcock & Wilcox, Ltd. Each consists of a cross-drum, marine-type water-tube boiler, complete with an integral superheater, economiser, air heater, grit arrestor, induced- and forced-draught fans, steel chimney, and two compartmental-type B. & W. chain-grate stokers. The new generating set is a 10,000-kW turbo-alternator with surface condensing plant, the complete set having been constructed and installed by the Metropolitan-Vickers Electrical Co., Ltd. The turbine is of the impulse type, and has an overload capacity of 12,500 kW. A new cooling tower, supplied and erected by the Davenport Engineering Co., Ltd., is also included in the extensions, and Messrs. W. J. Jenkins & Co., Ltd., have installed new coal- and ash-handling plant. Two additional boiler feed pumps of the steam-electric centrifugal type have been supplied and erected by Messrs. G. & J. Weir, Ltd.

At the opening ceremony Ald. H. Leese, J.P., chairman, Electricity Supply Committee, formally inaugurated the extensions in the presence of about 300 people, including members and officials of the Corporation and visitors from other districts. The mayoress (Mrs. Walker) started up the new generating set, which is the sixth installed, and the vice-chairman of the committee (Ald. G. Hassall) closed the alternator switch. The works were then inspected by the visitors, who later adjourned to the Town Hall, Stoke, for luncheon, at which Ald. Leese presided and gave a detailed description of the new buildings and plant. In the course of a statement regarding the development of the city's electricity supply, Ald. Leese said the four old undertakings came under the control of one committee in 1910, and they had since given close and continuous attention to the provision of an efficient power station, a huge network of mains, and a live selling organisation. A cheap supply meant a large supply, taken for all kinds of purposes over a long number of hours every day in the year.

In 1913, every unit generated at the power house took 6¾ lb. of coal; in 1927 the requirement was 2¼ lb. per kWh. Less than 7,000,000 units were produced in 1913 from 20,000 odd tons of coal, whereas last year 22,000,000 units were produced from 30,000 tons. The first scheme, in 1913, cost about £60,000, compared with a cost of about £160,000 in respect of the present scheme. It was true the capital was increasing rapidly, but the plant had to be provided in advance of requirements, and there was no sign of slackening off in new business. Rather the reverse was the case. Every extension with improved plant lowered the costs, enabling the price to be reduced, and this was followed by further increase in consumption.

Ald. Hassall paid a tribute to the contractors for the expeditious manner in which the work had been carried out.

Mr. F. E. Rycroft replied on behalf of Messrs. Babcock and Wilcox, Ltd., and Mr. A. McKinstry on behalf of the Metropolitan-Vickers Electrical Co., Ltd.; they referred to the valuable assistance which they had received from the city electrical engineer (Mr. C. H. Yeaman) and from the members of the Electricity Supply Committee. Mr. McKinstry remarked that Stoke-on-Trent had set about giving a cheap and abundant supply, and he thought that whatever they might do for the extension of the supply would be a good investment. In Stoke-on-Trent they had men who were fully alive to the possibilities of the use of electricity.

Mr. F. W. Purse, president I.M.E.A., proposed a vote of thanks to the chairman which Mr. T. Roles, electrical engineer and manager, Bradford, seconded.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Re-Assembly.

Parliament reassembled for the Autumn Session on November 8th.

The Unemployed.

Despite considerable Labour opposition, the Government's new Unemployment Insurance Bill, founded largely on the recommendations of the Blanesburgh Committee, has been read a second time. The first principle of the Bill is to abolish the discretionary power of the Minister of Labour to place restrictions on the grant of benefit and this is made payable as a right when the requisite conditions are fulfilled. The Bill creates a new class of insured persons, between the ages of 18 and 21. The scale of payments is adjusted and the conditions relating to dependants are re-defined. The qualification for benefit is altered and the rules limiting payments are cancelled. Other clauses relate to the payment of benefit by associations, a five-yearly investigation into the position of the Fund, &c.

The Piccadilly Tube.

On November 8th Mr. R. MORRISON asked the Minister of Transport whether he had any information as to when the Piccadilly Tube would be extended northwards from Finsbury Park.

Colonel ASHLEY said he understood that the company was not prepared to proceed further with the matter at present.

Trade with Russia.

On November 8th, Sir P. CUNLIFFE-LISTER, President of the Board of Trade, informed Lt.-Commander Kenworthy that during the three months July-September, our imports from Russia were, in 1927, £7,600,000; in 1926, £6,400,000. During the same three months our exports, in 1927, were £1,022,000; in 1926, £1,200,000; and in the same three-monthly period of 1927 our re-exports were £800,000, and in that of 1926, £2,200,000.

Wireless Telephony to the United States.

On November 8th, Sir F. WISE asked the Postmaster-General if he would state the number of wireless telephony calls between England and the United States and *vice versâ*.

Sir W. MITCHELL-THOMSON said that the figures up to November 6th were as follows:—Calls from Great Britain 830; calls from United States 991.

New Electricity Schemes.

On November 10th, Major GLYN asked the Minister of Transport whether he was aware that the cost of generating electricity in the stations which were to be displaced under the new South-East England electricity scheme, now ½d. a unit, had been estimated to be ¼d. under the new authority; and whether it was intended, in order that country districts might

participate in the saving thus effected, to average the charge with the populated areas or to reduce the distributing costs by overhead transmission.

Colonel ASHLEY said that with regard to the question of tariffs for electricity supplied by the Central Electricity Board, he would refer to the provisions contained in Section 11 of the Electricity (Supply) Act, 1926. With regard to the point raised in the last part of the question, he had no doubt that undertakers would in order to diminish the cost of distribution, adopt overhead transmission so far as possible.

Mr. BARNES asked the Minister whether he was aware that a large number of authorised undertakers had asked the Central Electricity Board to extend the time for representations on the South-East England electricity scheme and that their request had been refused; and whether he would endeavour to obtain a reversal of that decision.

Colonel ASHLEY replied that the matter was one within the discretion of the Central Electricity Board. He understood, however, that although the time required by the Act was one month, the Board fixed six weeks in the case of this scheme.

Mr. BARNES then asked the Minister whether, in view of the magnitude of the interests concerned, he would represent to the Central Electricity Board the desirability of holding a public inquiry into the South-East England electricity scheme as contemplated in Section 4 of the Electricity (Supply) Act, 1926.

Colonel ASHLEY said that the nature of the inquiries to be held by the Central Electricity Board was a matter expressly left to its discretion by the statute, and he understood that the form of procedure to be adopted by the Board would be decided when it had received and examined the representations made to it.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Resistance Amplifiers.

I regret that I have been prevented from replying to Mr. Frank Phillips's letter of September 14th, and trust that my comments may still be of interest. Mr. Phillips raises so many points that I had better deal with them *seriatim*. First of all let me say, however, that my views on all the points which have been raised are quite unchanged, and in the main I really feel that Mr. Phillips and myself are quite agreed on the fundamental principles underlying the design of resistance amplifiers.

Mr. Phillips points out that the amplification obtained is a function not of the condenser alone but of the condenser and the leak. With this I am, of course, in entire agreement. If my article is examined carefully it will be found that I mention that the whole problem simply reduces to applying Ohm's law to a network of capacities and resistances. As my article was not intended in any way as a technical contribution, but was essentially for the intelligent wireless dealer, I only mentioned what I considered the salient features. I am sure it will be universally agreed that the value of the coupling condenser is perhaps the most important point. Mr. Phillips states that the amplification is actually a function of the time constant of the coupling condenser and the leak, and gives an expression from which the amplification can be obtained. I do not altogether like introducing the term "time constant" into the problem, although, looked at from a numerical point of view, this is quite accurate. Personally, I prefer to derive the expression from first principles and simply leave the terms R and C as such in the numerator and denominator instead of grouping them and considering them as the time constant.

For the benefit of readers who are not too familiar with the subject, perhaps Mr. Phillips will forgive me if I analyse the problem on very simple lines. As we are dealing with an anode resistance of the order of two or three times the impedance of the valve, we are justified in neglecting the inter-electrode capacities. What we actually have then is a condenser in series with a resistance across which is the applied voltage (that is, the coupling condenser and leak). What we require is the maximum possible voltage across the leak, that is, across the grid filament circuit of the next valve. The circuit is then comparable with an ordinary potentiometer. The applied voltages from the anode circuit are across CR, and, obviously, for the voltage across R to be large, the reactance of C must be low compared with the value of R. On this fundamental point both Mr. Phillips and myself appear to agree, both theoretically and mathematically. What we really do not agree upon, I think, is the allowable losses. Mr. Phillips states that we can lose as much as 30 per cent. to 40 per cent. without noticing it. In other words, this means that the human ear cannot appreciate small or even fairly large changes in intensity. Surely this is not the case. If it were there would be little pleasure in listening to music, and what would be the advantage of using straight-line amplifiers or taking care to remove undesired resonances throughout the whole acoustic and electrical system of a broadcast transmitter? What counts most in the human appreciation of sound intensity is the rate of change of intensity. Observations made on sound intensity introduce a large amount of personal element, and experiments made on single notes are almost useless. It is much better to obtain a straight-line electrical output and feed it into a speaker having an even response rather than to justify one's design from admittedly doubtful aural observations.

Another point to be borne in mind when deciding the value of the coupling condenser is the lowest frequency. Mr. Phillips gives 32 cycles; I prefer to work as low as 20 cycles. The B.B.C. transmits 20 cycles, which is a quite common musical frequency; modern speakers will reproduce 20 cycles, so why exclude it or limit it in one's amplifier at the expense of a slightly larger condenser? True, many cheap speakers tend to cut off below about 50 cycles, but this is surely all the more reason for obtaining the fullest bass amplification in order to make up for the loss due to the speaker. I quite appreciate Mr. Phillips's remarks about transients when using large coupling condensers, but I have never experienced any trouble in this respect even with condensers of the order of 1 mfd. in very low frequency amplifiers, except, of course, when first switching on.

I still contend most emphatically that the loss at 32 cycles with a 0.005 condenser and 1 megohm leak is far too considerable, while at 20 cycles it is vastly greater. Mr. Phillips's own formula, with which I agree, will show this.

The next point raised is the use of paper condensers. The fact is that the insulation resistance of a paper condenser is far greater than Mr. Phillips would lead us to believe. I think any condenser manufacturer will agree that 300 megohms per microfarad is an average figure for a good paper or, rather, paper-type condenser. By paper condenser I did not mean a Mansbridge condenser, but one with specially treated paper dielectric. Even allowing the low figure of 300 megohms per microfarad, a coupling condenser of 0.1 mfd. would have a resistance of 3,000 megohms. With better dielectrics this figure is exceeded. Having carried out some research on synthetic dielectrics, I have a fairly intimate knowledge of their insulation resistance. The chief advantage of mica is its safety, as the breakdown voltage is high. The breakdown voltage is not, of course, a direct function of the specific resistance. The power factor is admittedly superior, but this is of little importance I really fail to see the objection to its use, especially when a large condenser is going to do so much in keeping up the bass amplification. In an ordinary receiving set the voltages are too low to give rise to breakdowns.

The question of "motor-boating" is rather difficult, but I do not think that we should run the risk of sacrificing amplification by being tempted to use too small a coupling condenser, when it is possible to eliminate "motor-boating" by other means.

I think that I have made my reasons for using coupling condensers of the order of 0.1 mfd. abundantly clear, and trust that Mr. Phillips will follow my justification. I may add that in commercially-built apparatus of the type used for broadcast work or public address it is customary to use condensers *at least* of the order stated in my article. In conclusion, I would like to thank Mr. Phillips for his interest in, and views on, this rather important subject.

Paul D. Tyers.

Watford, *November 7th*, 1927.

Automatic Telephone Tone Signals.

I have read with interest the article on "Automatic Telephone Tone Signals" in your issue of November 4th, and I think that Mr. Durkin exaggerates the possibility of confusion occurring, due to the adoption of tone signals in the Post Office standard system.

It is perhaps not generally appreciated that full verbal instructions are given to all subscribers at the time when their automatic 'phones are being installed; also demonstration models, for the special instruction of subscribers, are provided at those manual exchanges about to be converted to automatic working.

In the case of call office subscribers, cards bearing brief and lucid instructions are fitted in every coin box cabinet, which should enable anyone to discriminate between the various tones. In these instructions the subscriber is informed that in the event of any difficulty arising he can reach an operator immediately by dialling "O."

With regard to the subscriber's difficulty in memorising the various tones, since dialling signal and N.U. tone are continuous, while ringing signal and busy tone are interrupted: ignoring the fact that they are completely dissimilar, it would appear possible to mistake dialling signal for N.U. tone and ringing signal for busy tone. Now it is reasonable to suppose that even the least intelligent non subscriber using an automatic 'phone for the first time will not expect to be notified either verbally or otherwise that his call is effective or ineffective *before* he has initiated it by dialling the required number. Therefore one is justified in assuming that no confusion can arise between dialling signal and N.U. tone.

Admitting that the average subscriber when confronted with the simplest instructions is reduced to a condition of mental prostration, there certainly is a possibility that ringing signal may be mistaken for busy tone, although the difference should be apparent to anyone, since ringing signal consists of an interrupted rattle at a frequency of 133 cycles a second, while busy tone is a comparatively high interrupted note at 400 cycles a second.

Mr. Durkin has certainly suggested a very practical alternative system, but I do not think that his criticism of the tone system will be vindicated by experience.

J. M. Lawrence.

Charlton, *November 7th*, 1927.

A Novel Switchplug.

We notice that in your number dated November 11th, on page No. 836, you describe what is called a "novel switchplug." Do you not consider that this title is entirely misleading? We would agree with you in calling it a novel plug, but switchplug surely is not the correct term. This "switchplug," as you will note, is not a switch plug in any sense of the word, since it does not incorporate a switch; it is in fact merely a novel 3-pin plug with a spring shutter, which like every other plain plug connection will require a separate switch for controlling. It is noted that a spring mechanism gives a final "kick" to the plug when being inserted. It is, of course, extremely useful to give a snap action to a contact which has already been made. We shall be glad to know, too, what is the utility of a *preliminary* "kick" when the plug is being removed, since in any case the final motion is absolutely dependent upon the operator who can withdraw the plug as slowly as he pleases. We should be interested to know if the term "switchplug" is derived from this particular mechanism.

The Wandsworth Electrical Mfg. Co., Ltd.

November 11th, 1927.

[The "kick" referred to above, as clearly stated in our description, is final to both the in and out motions, giving a definite quick-make and -break feature. This, we think, justifies the title "switch-plug," but maybe our correspondent would prefer "quick-make-and-break plug."—Eds. Elec. Rev.]

Trailing Cables for Mines.

Allow me to take the opportunity of thanking your correspondent, Mr. C. Jones, for his appreciative remarks, and for pointing out the wording quoted in the first paragraph of his letter.

The point I have in mind is the possibility of breaking into gas during cutting operations and the presence of coal dust which exists in considerable quantities at "machine got" coal faces.

E. P. Austin.

Chesterfield, *November 14th*, 1927.

Legal.

The Marconi Capital Reduction.

The petition of Marconi's Wireless Telegraph Co., Ltd., for confirmation by the Court of a proposed reduction of capital to be effected by writing down the ordinary shares from £1 to 10s., came before Mr. Justice Eve in the Chancery Division on November 8th.

Mr. Wilfrid Greene, K.C., for the company said that notice of opposition had been given on behalf of the holders of 13,268 ordinary shares out of an issued capital of 3,250,011 ordinary shares, 400 preference shares out of 250,000 issued, and £300 worth of debenture stock out of £1,357,042. In support of the petition was a most exhaustive report prepared by Sir Gilbert Garnsey; and Senatore Marconi had made affidavits. The latter was ill, and therefore unable to attend. Mr. C. L. Nordon and Mr. A. P. Pennell were opposing the scheme.

Mr. Greene said the company was formed in 1897, and to-day held interests in 50 or 60 subsidiary companies all over the world. Its present capital was 250,000 7 per cent. cumulative participating preference shares of £1 and 3,750,000 ordinary shares of £1, making a total of £4,000,000. All the preference shares had been issued, and all the ordinary except 499,935. There was also in existence £1,357,042 of 6½ per cent. convertible debenture stock. The company in 1923 and 1924 utilised a considerable portion of a very large reserve fund to write down assets to the extent of slightly over £3,000,000. When the draft balance sheet for 1925 was prepared provision was made for further writing down out of reserve of £977,278. The board then decided that the only proper course was to have the entire position of the company and its subsidiary concerns most carefully investigated, and they instructed Sir Gilbert Garnsey in collaboration with Messrs. Cooper Bros. and Co., the company's auditors, to do this. Those gentlemen recommended that a further £2,310,362 should be written off, making a total of £3,284,455. They also recommended that the patents held by the company which appeared in the books at £376,783 should be written down to £1, and that had been done out of reserve. After deducting trading profit and allowing for other matters, there was £1,625,794 to be provided for by reduction of capital.

Mr. Nordon said he was not seeking to bring a charge of fraud but one of grave irregularities. In his affidavit he submitted that the scheme would constitute a great injustice to the shareholders and debenture holders, and ought not to be confirmed.

Sir Gilbert Garnsey was cross-examined on November 9th by Mr. Nordon. The witness said that if Mr. Nordon had had the same facts and figures he would have reached the same conclusions. He also said that £15,000 had been reserved for expenses in connection with the reduction of capital.

Mr. Nordon asked if it would be reasonable to make this addition to the scheme: "The company undertaking that all capital assets written down for the purpose of capital reduction shall be carried in the books to a separate schedule at the written-down values, and that all surpluses and realisations from time to time shall be carried to a special reserve fund, which shall be distributed as dividends." Sir Gilbert said that he had no objection to the condition, but at the moment there was no surplus.

Questioned with regard to the company's patents, Sir Gilbert said that the writing-down was not part of the loss in respect of which the capital reduction was sought. The patents had been written down out of reserves. He added that large royalties had been received, and that 94 per cent. of them during the last three or four years were derived from broadcasting. In 1923, 1924, and 1925 the expenditure incurred in order to maintain the patent position exceeded the gross royalties received. It would obviously be wrong to value the patents, or indeed any other asset, on the basis of gross income received. the moment they took the patents away from the business they would have to scrap the plant. If they deducted the losses attributable to the company and to its subsidiaries during the past six years, there remained a profit of between £180,000 to £200,000 per annum. The capital employed in earning that profit was £1,875,000, but the average capital for the period he was dealing with would be about four millions.

Mr. Nordon asked whether, beside the large salary paid to Senatore Marconi, he also was paid individually £8,000 a year? Witness said that was for research work; expenses incurred in connection with the yacht *Electra*. He repudiated a suggestion that the yacht was nothing more than a palatial place of entertainment.

Questioned next in regard to the Television Co., Sir Gilbert said that the capital was £600,000, and the company paid Mr. Baird £150,000 for his patents. He agreed that optimistic statements had been made regarding the company's claim against the Government for the use of patents during the war, but it was not now hoped that large sums would be received. It was stated by Mr. Hodge (for Senatore Marconi) that his client received £80,000 for his patents.

Sir Gilbert was next questioned by Mr. A. P. Pennell. He agreed that it was alleged that the company's reserve fund and much of its capital had gone, and that he understood that during the last six years large dividends had been paid. Asked if he thought that those dividends could be recovered from the directors, Sir Gilbert said that he could not deal with that question.

Answering further questions, Sir Gilbert said he put the losses in connection with the Argentine Marconi Co. at £150,000. The wireless station there was never built.

Mr. Pennell said that there were very large sums that should be recovered from Senatore Marconi, and he alleged that he had been guilty of fraud.

Further questions as to directors' remuneration drew a protest from the Judge against the case being turned into misfeasance proceedings, and the hearing was adjourned.

The hearing was concluded on November 10th. Mr. Justice Eve asked Mr. Nordon how his questions to Sir Gilbert Garnsey relating to payments to directors, &c., could shake the conclusions at which Sir Gilbert had arrived. Mr. Nordon said that he hoped to show that the outgoings which had been referred to were unnecessary and that Sir Gilbert's arguments and conclusions were fallacious. Enormous sums had been received by the company, but in 1925 the directors drew £59,000 plus £8,000 and their expenses, and other employés drew £95,000. Mr. Kellaway might be able to throw light on the matter.

Mr. F. G. Kellaway then gave evidence. He considered that there was an overwhelming majority in favour of the proposed reduction. Asked if the company was capable of making a net profit of £480,000 per year with proper management, witness said that he saw no prospect of that for many years ahead. He agreed that the chairman, technical adviser, managing director, and administration had been paid £173,909. When he became managing director of the company they put a stop to the payment of fees to directors of subsidiary companies who were also members of the Marconi staff. He claimed that only the existence of Senatore Marconi's yacht had enabled them to prove the beam system. It was further stated that Senatore Marconi once saved the company by buying at par shares which could not be sold for 10s. Mr.

Kellaway said that his salary was £10 000 per year, of which 20 per cent. was paid by the International Marine Co., plus expenses amounting to £800 or £900. In conclusion, the witness said that an unjust charge had been made against a British officer in Argentina; the charge had been dismissed by the Argentine Court.

Mr. GREENE claimed that the charges which had been made were irrelevant, and should never have been mentioned. The ordinary shareholders, as a majority, were in favour of the scheme.

Sir ALBION RICHARDSON dissociated himself from the allegations of fraud which had been made, and Mr. NORDON said that he made no attack upon anybody. He was concerned with the fact that the public had subscribed £7,000,000, from which a reasonable return was expected. Mr. PENNELL said he would withdraw his charge against the officer in connection with the Argentine Company.

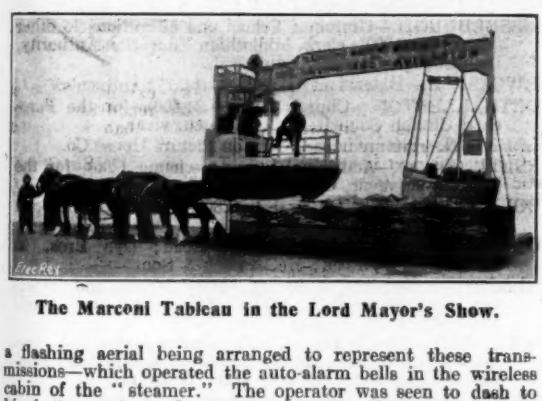
His LORDSHIP confirmed the reduction, and released the company from the obligation to insert the words "and reduced" after its name. He said that the seriousness of the loss and the number of shareholders affected had caused him to allow the evidence to range over a far wider extent than he would otherwise have done.

Marconiphone Co.'s Capital Reduction.

ON November 10th, Mr. Justice Eve confirmed the reduction of the capital of the Marconiphone Co., Ltd., from £450,000 to £90,000.

The Lord Mayor's Show.

WE reproduce herewith a photograph of the display of the Marconi International Marine Communication Co., Ltd., in this year's Lord Mayor's Show, to which reference was made in our last issue. Upon the tableau a dramatic scene was enacted. The lifeboat was seen to send out an alarm signal—



The Marconi Tableau in the Lord Mayor's Show.

a flashing aerial being arranged to represent these transmissions—which operated the auto-alarm bells in the wireless cabin of the "steamer." The operator was seen to dash to his instrument, send a message to the lifeboat, and take bearings of its position by means of a wireless direction finder.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1926.

10,541. "Packing for use particularly with moving machine or engine parts." Crane Packing, Ltd., and F. C. W. Wilkinson. April 21st, 1926. (279,148.)

17,626. "Electrically-operated power hammers or presses for working metal." A. Friederici. July 14th, 1925. (255,461.)

18,112. "Illuminating devices suitable for display or advertising purposes." F. H. Eeles. July 20th, 1926. (279,161.)

18,127. "Prismatic reflectors." Holophane, Ltd. (T. W. Rolph). July 20th, 1926. (279,162.)

18,144. "Igniting or lighting devices." P. M. Salerni. July 20th, 1926. (Cognate application 23,821/26.) (279,163.)

18,365. "Four-electrode valves." H. J. Round. July 22nd, 1926. (279,171.)

18,370. "Loaded conductors." P. S. McCann and Western Electric Co., Inc. July 22nd, 1926. (279,172.)

18,423. "Regulation of electric distribution systems." British Thomson-Houston Co., Ltd., and H. De B. Knight. July 23rd, 1926. (279,174.)

18,661. "Wireless receiving apparatus." F. Pink. July 26th, 1926. (279,182.)

19,734. "Electric starters for internal-combustion engines." R. L. Aspden and Aspden Flywheel Dynamotor Syndicate, Ltd. August 10th, 1926. (279,194.)

19,915. "Electric welding apparatus." E. G. Budd Manufacturing Co. August 27th, 1925. (257,591.)

20,340. "Ships' telegraphs." A. Robinson & Co., Ltd., and E. A. Lambert. August 18th, 1926. (279,196.)

20,679. "Thermionic valve amplifier circuits." British Thomson-Houston Co., Ltd., and T. H. Kinman. August 21st, 1926. (279,202.)

20,774. "Amplifiers for talking machines and the like sound reproducing apparatus." C. E. C. J. Manby. August 23rd, 1926. (279,203.)

22,041. "Voltage-regulating systems." Igranic Electric Co., Ltd., J. H. Abbink-Spaink, and J. R. Taylor. September 7th, 1926. (279,212.)

22,218. "Electric fuses and the manufacture thereof." Simplex Conduits, Ltd., and H. F. McLoughlin. September 2nd, 1926. (Divided application on 21,610/26.) (279,213.)

22,362. "Smoothing apparatus for direct-current supply systems." W. J. Brown and Metropolitan-Vickers Electrical Co., Ltd. September 10th, 1926. (279,214.)

23,442. "Terminal protection box for all makes of electric supply meters." D. E. Rees. September 11th, 1926. (279,216.)

22,884. "Railway signals." Siemens & Halske Akt.-Ges. June 5th, 1926. (272,106.)

23,815. "Electric batteries." W. E. Stichling. September 27th, 1926. (279,228.)

26,864. "Wireless apparatus." H. Quartermaine. October 27th, 1926. (279,246.)

27,250. "Means of suspending aerial wires." P. W. Baker, R. M. Ellis, and C. H. Stave. October 30th, 1926. (279,251.)

27,921. "Wired wireless systems." Electrical Improvements, Ltd., and L. C. Grant. November 6th, 1926. (279,255.)

27,986. "Means for starting internal-combustion engines." T. H. Bates. July 14th, 1927. (279,256.)

28,484. "Rectifier for alternating electric currents of low frequencies." R. P. Le Bensing. November 12th, 1926. (279,259.)

29,576. "Sparking plugs." W. Stirnberg. November 23rd, 1926. (279,267.)

30,794. "Railway train control systems." Continuous Train Control Corporation. December 5th, 1925. (262,469.)

1927.

343. "Electrically-controlled door-opening apparatus." National Pneumatic Co. January 6th, 1926. (264,162.)

728. "Electro-magnets and the like." Landis & Gyr Soc. Anon. January 29th, 1926. (265,172.)

3,113. "Protective systems for electric distribution systems." British Thomson-Houston Co., Ltd. February 13th, 1926. (265,952.)

3,454. "Engine starters." F. H. Rogers (Eclipse Machine Co.). February 7th, 1927. (279,296.)

3,662. "Electromagnetic devices, suitable for use in sound-recording and reproducing devices and the like." Western Electric Co., Inc. May 24th, 1926. (Addition to 260,946.) (271,409.)

3,674. "Electrical hoisting and lowering apparatus." Naamlooze Vennootschap Hengelosche Electrische En Mechanische Apparaten-Fabriek, and A. Booden. February 9th, 1927. (279,297.)

3,779. "Damping acoustic and like vibrations." A. F. Sykes. April 22nd, 1926. (Cognate application 4,526/27.) (Divided application on 263,502.) (279,299.)

4,395. "Electric brush for use on the hair, scalp, body, and toilet generally." H. W. Lapthorn. February 16th, 1927. (279,304.)

4,448. "Base for an electron tube or thermionic valve bulb." Ideal Radiotelefon & Apparatefabrik Ges. July 9th, 1926. (274,028.)

4,503. "Ear-pads for telephonic receivers and the like." E. A. V. Sanftleben. February 17th, 1927. (279,305.)

5,012. "Apparatus associated with the synchronising of electric circuits." British Thomson-Houston Co., Ltd. February 23rd, 1926. (266,718.)

5,254. "Induction-type alternating-current relays." Allmanna Svenska Elektriska Aktiebolaget. October 14th, 1926. (279,019.)

6,033. "Method of controlling automatically the recharging of accumulator batteries from the supply mains, applicable to electric clock circuits and the like." T. J. Murday. March 3rd, 1927. (279,311.)

7,085. "Loud speakers." Siemens & Halske Akt. Ges. March 15th, 1926. (267,564.)

9,621. "Means for reclosing switches after they have been opened by an excess current." Akt.-Ges. Brown, Boveri et Cie. April 19th, 1926. (269,827.)

10,929. "Electric protective systems and apparatus therefor." British Thomson-Houston Co., Ltd. May 4th, 1926. (270,678.)

11,128. "Device for illuminating display windows." W. Lundt. April 26th, 1927. (279,331.)

11,173. "Röntgen diaphragm." R. Manni. April 30th, 1926. (270,209.)

12,926. "System for controlling the performances of electrically-operated apparatus by means of a measuring device." Siemens & Halske Akt.-Ges. May 14th, 1926. (271,105.)

14,861. "Electric furnaces." Akt.-Ges. Brown, Boveri et Cie. June 7th, 1926. (272,227.)

17,767. "Electric selecting mechanism particularly applicable to type-printing telegraphy." Morkrum-Kleinschmidt Corporation. July 16th, 1926. (274,448.)

19,593. "System of connections for multiple thermionic valves." Dr. S Loewe. July 20th, 1926. (274,701.)

24,443. "Unidirectional electric current carrying devices." Metropolitan-Vickers Electrical Co., Ltd. September 16th, 1926. (277,684.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the applications may be lodged within one month from November 9th. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Vinnapas. No. 484,596. All goods in class 1.—Consortium für Elektrochemische Industrie Gesellschaft, Munich. (Abel & Imray, 30, Southampton Buildings, Chancery Lane, W.C.2.)

B (lettering and design). No. 479,290. Class 8. Radio-telegraphic and telephonic apparatus, and electrical measuring instruments.—Badische Uhrenfabrik Gesellschaft, Furtwangen, Germany. (A. P. Thurston, Bank Chambers, 329, High Holborn, W.C.1.)

Fidelia. No. 483,777. Class 8. Radio-telephonic and telegraphic apparatus, &c.—J. M. Shearer and two others trading in co-partnership, 48, Burnbury Road, Balham, S.W.12.

Megite (lettering and design), No. 483,855, and Ohmite (lettering and design), No. 483,856. Class 8. Electrical resistances.—T. G. Farish, 46, Culverley Road, Catford, S.E.6.

Defreezer. No. 484,497. Class 8. Electric transformers.—U. Alcock, Station Road, Beaconsfield, Bucks.

Memset. No. 482,887. Class 13. Electric switches (ordinary) and electrical fuses.—Midland Electric Manufacturing Co., Ltd.

Miners' Welfare National Scholarship Scheme.

The trustees of the Miners' Welfare National Scholarship Scheme invite applications for a limited number of University scholarships from workers in or about coal mines in Great Britain, or sons or daughters of such workers, who must be not less than 17 years of age on February 14th, 1928. Forms of application and full particulars may be obtained from the Secretary, Miners' Welfare National Scholarship Scheme, Mines Department, Dean Stanley Street, London, S.W.1. Forms received after February 14th, 1928, cannot be considered.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYCLIFFE.—Mental colony for Durham C.C.; Rees & Holt, architects.

BARNSTAPLE.—Bank, Boutport Street, for Westminster Bank, Ltd.; Oliver & Son, architects. Billiards hall; J. M. Curry.

BEBINGTON AND BROMBOROUGH.—Additional housing scheme (134), for the U.D.C.; surveyor.

BRADFORD.—First block of new Royal Infirmary, Daisy Hill; Morley & Son, architects; builders, Alfred Robinson, Woodbine Works, Idle.

BRANDON (Rugby).—Power station, &c., Coventry Road, for the Coventry Greyhound Racing Co., Ltd.

BRISTOL.—Offices, Avonmouth Docks; Elders, Fyffes, Ltd. Rebuilding, 29, College Street (£4,000).—J. Venderplank.

CARLTON.—Clinic and welfare centre; Notts C.C.

CHELMSFORD.—Pumping station, filter house, and workmen's dwellings, Sandford Mill waterworks, for the T.C.; E. J. Miles, borough engineer.

CHESTER.—Extensions to nurses' home, Royal Infirmary; Thompson & Walford, architects, Leadenhall Buildings, London, E.C.

CRADLEY HEATH.—Re-erection of portion of joinery works, electrically equipped, for Mark Round & Sons, Plant Street.

CREWE.—Cottage hospital extensions (£18,000); James Martin, architect. Nurses' quarters, Maternity Home, for the T.C.; E. G. Timbrell, borough architect.

DERBY.—Factory, Sinfin Lane, for Messrs. F. W. Hampshire and Co., Riverside Works.

DEVONPORT.—134 houses, St. Budeaux; Devonport Dockyard Employés Association, Ltd. Science laboratory, Devonport High School; Plymouth Education Committee.

DOUGLAS (I.O.M.).—50 houses, Pulrose Estate; Mr. Teare, Corporation architect. Rebuilding of White City Amusement Park, Onchan; manager.

DOVER.—Extensions to paper mills, Crabble, for Wiggins, Teape & Co.; Hayward & Paramor, contractors. Garage, with lifts, for the Cambrian Coach Co.

DUDLEY.—Infectious diseases hospital, Priory Estate; borough engineer.

DUNDEE.—Greyhound racecourse at Esplanade (electric control house); W. Inglis, architect, 216, Bath Street, Glasgow.

EASTBOURNE.—Extensions, for the *Gazette and Herald*; Walter R. Hamblyn, architect, 51b, Seaside Road. Branch library, for the T.C.; Leslie Roseveare, borough engineer.

FIFESHIRE.—Extension of schools for Fife Education Authority (£17,000); the clerk, Kirkcaldy.

GLASGOW.—Church at Kelvindale (£25,000); minister, St. John's U.F. Church. 30 houses, Keppochhill Road; housing director.

GLOSSOP.—Additions, Jubilee Mills; Olive & Partington. Conversion, Whitfield School, into flats; Joseph Hague Educational Trustees.

GRAVESEND.—Out-patients' block, Gravesend Hospital; Governors.

HANTS.—Schools, Clanfield, Droxford, Eastleigh, Hartley Wintney, and Nether Wallop, for the E.C.; director of education, Winchester.

HATFIELD (Herts.).—Housing scheme (68), for the R.D.C.; surveyor.

HERNE BAY.—Municipal offices, for the U.D.C.; C. Harold Norton, architect, 14, Bedford Row, London, W.C.

HERTFORD.—Additional housing scheme (150), for the T.C.; borough surveyor.

HULL.—39 houses, Clarence Street; C. Donald Allderidge, architect. High School; city architect. Cinema, Brazil Street; Freeman, Son & Gaskill, 11, Carr Lane, architects.

JEDBURGH.—Extensions at Cottage Hospital and introduction of X-ray equipment; K. McKenzie, National Bank House, hon. treasurer.

KNARESBOROUGH.—Extensions to institution (£11,675), for the B.G.; clerk.

LEEDS.—Extensions, Sun Ray Department, Cookridge Street baths; city engineer.

LONDON (E.1).—Shops and flats, in New Street, Middlesex Street, for the City Council (£24,986); L. & W. Whitehead, Ltd., contractors.

(Edgware, N.).—Greyhound racing track, for Greyhound Racing Cynodromes, Ltd.; R. G. Wooten, managing director, Brentwood Place, Golders Green.

(Beckenham, S.E.).—Municipal offices, for the U.D.C.; Lanchester, Lucas & Lodge, architects. School (1,200 places), for the E.C.; F. W. Gedney, clerk.

(Greenwich, S.E.).—76 houses, Charlton Estate; borough engineer.

(Fulham, S.W.)—Buildings for Conservative Club, Shorrolds Road; Wm. Doddington.

(Westminster, S.W.).—North Block, Grosvenor House site; Wimperis, Simpson & Guthrie.

MANCHESTER.—Cinema, Langworthy Road, Pendleton, for the Ambassador Super Cinema, Ltd.; John Knight, architect, 5, Cross Street. Extension of the College of Technology, Sackville Street; city architect, Town Hall.

MANSFIELD.—Reconstruction, Grand Theatre; licensee.

MARKET HARBOROUGH.—Premises, High Street; F. W. Woolworth & Co., Ltd.

MELKSHAM.—Police station and quarters, for Wilts. C.C.; T. Walker, county architect, Trowbridge.

MITCHAM.—Cottage hospital (£21,684); S. Dale, builder.

MUSSELBURGH.—Grammar School and alterations to other schools (£39,200); clerk, Midlothian Education Authority, Drumsheugh Gardens, Edinburgh.

NEWCASTLE.—Extensions, Royal Infirmary; Governors.

NORTHALLERTON.—Church house (£4,500), for the Parochial Church Council; Canon Brown, vicar.

OLLERTON.—Picture house; Ollerton Picture House Co.

ORSETT (Essex).—Additional housing scheme (200), for the R.D.C.; surveyor, Grays.

POOLE.—Two schools (£60,000 to £80,000), for the borough E.C.; town clerk.

PORTSMOUTH.—32 houses, Allcott Road; Dye Bros. 26 houses, Target Road; McCormack & Son.

PRESCOT.—Extensions, including nurses' lecture and recreation room, for the B.G.; William Ellis, architect, 9, Hardshaw Street, St. Helens.

RAWMARSH.—Middle School, with mining centre and caretaker's house; also Middle School at Rossington; Education Department, County Hall, Wakefield.

RIPON.—Extensions, Cottage Hospital; governors.

ROSSINGTON.—Middle School; Education Department, County Hall, Wakefield.

ST. HELENS.—Workshops, saleshop, offices and social centre, for the Society for the Blind; Biram & Fletcher, architects, George Street. Garage, Tolver Street, for Tramways Department; A. W. Bradley; borough engineer, Town Hall.

ST. LAWRENCE (Isle of Wight).—Rest home (£2,000); J. E. Harrison, architect, Ventnor.

SANDY (Beds.).—Housing scheme (50), for the U.D.C.; Mr. Robinson, surveyor.

SHEFFIELD.—88 houses, Longley Estate; M. J. Gleeson, Ltd. 47 houses, Longley Estate; Drabble Bros., Josborough. 57 houses, Wybourn Estate; city architect.

SKEGNESS.—Boys' Convalescent Home (£5,000), for the Nottingham Poor Boys' Society; W. Greetham, Drummond Road, builder.

SLEAFORD.—Electricity installation, Grantham Road; British Petroleum Co., Ltd.

SPALDING.—Additional housing scheme (52), for the U.D.C.; A. E. Palmer, architect.

STOURBRIDGE.—Additional housing scheme (292), High Park Farm Estate, for the T.C.; borough surveyor.

SWADLINCOTE.—Pottery factory, Moira, for the Moira Pottery Co. (several thousand pounds).

TORQUAY.—Private ward and administration buildings at isolation hospital; borough engineer. Rendezvous (£20,000); borough engineer.

WARRINGTON.—Housing scheme (32), Bewsey Estate, for the T.C.; A. M. Ker, borough engineer.

WESTON-SUPER-MARE.—Premises, High Street, for J. Lyons & Co., Cadby Hall, London, S.W.

WOKINGHAM.—Housing scheme (60), for the R.D.C.; surveyor.

YORK.—Greyhound racing track, Mount Vale, for York Sports Club, Ltd. Pavilion Hospital; city engineer.